# CHAPTER 2
# ALTERNATIVES INCLUDING THE APPLICANT'S PROPOSAL

## 2.1 OVERVIEW OF ALTERNATIVES AND SCREENING PROCESS

This chapter describes the alternatives considered for the Southern Intertie Project. It describes the Project alternatives that were considered but not analyzed in detail, and the criteria and rationale for their elimination. It also describes the route selection process, alternative routes considered but eliminated, IPG's proposed Enstar Route, and other routing alternatives on the Kenai Peninsula, through the Turnagain Arm, and in Anchorage. The route alternative, the Tesoro Route, and optional routings that were considered in detail for this alternative route are also described. These two main routes and sub-regional routing options constitute a reasonable range of alternatives consistent with the purpose and need. The chapter then compares the environmental impacts of the alternatives, including the Applicant's proposal.

An array of alternatives were screened based on their capability to meet the seven criteria discussed in Chapter 1 under the project purpose and need. Several alternatives met or partially met some of the alternative screening criteria. They included BESS, increased spinning reserves, upgrading the Quartz Creek transmission line, installing a new transmission line underground, and installing a new line at a higher voltage of 230kV. Three other alternatives (DSM, energy efficiency and conservation, and new generation), which would either reduce the electricity load requirements of the system or provide additional power to the system, were also considered but did not meet any of the screening criteria. The reasons these alternatives were not studied further are provided below. That information is also summarized in Table 2-1 and explains how alternatives were evaluated against purpose and need criteria.

## 2.2 ALTERNATIVES STUDIED AND ELIMINATED FROM DETAILED STUDY

### 2.2.1 Alternatives to a Transmission Option

**Battery Energy Storage Systems**

A BESS consists of a very large bank of electric batteries and automatically controlled electronic equipment to convert the electric energy stored in the batteries from DC to AC. This energy can be supplied to or absorbed from the electrical transmission system virtually instantaneously. This capability allows a BESS to compensate very quickly for imbalances between generation and load. However, a BESS can only be operated to support the system for a very limited period of time (20 to 30 minutes). A BESS could be particularly applicable to address the need for increasing the reliability of the Railbelt system and improving overall system stability during disturbances. A BESS is being evaluated by GVEA for installation in Fairbanks.

**TABLE 2-1**
**ALTERNATIVE SCREENING SUMMARY**

| Project Alternatives | *No Action | Alternatives Considered but Eliminated | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alternatives to a Transmission Option | | | | | | | Transmission Options | | Applicant's Proposal |
| Project Objective (Purpose and Need) | *No Action | Battery Energy Storage System | Demand Side Management | Energy Efficiency/ Conservation | New Generation | Wind Generation | Fuel Cells | Increased Spinning Reserves | Upgrade the Quartz Creek Line | Parallel Line on Quartz Creek Route | New Line on Enstar or Tesoro Route |
| **Alternative Screening Criteria** | | | | | | | | | | | |
| Increase the reliability of the interconnected system | no | partial | no | no | no | no | no | yes | no | partial | yes |
| Increase the power transfer capacity between the Kenai Peninsula and Anchorage | no | partial | no | no | no | no | no | no | partial | partial | yes |
| Utilize the most economic generation mix to reduce costs | no | partial | no | no | no | no | no | no | partial | partial | yes |
| Improve overall system stability during disturbances | no | partial | no | no | no | no | no | yes | no | partial | yes |
| Reduce spinning reserve requirements | no | partial | no | no | no | no | no | no | no | partial | yes |
| Reduce transmission line losses | no | no | no | no | no | no | no | no | partial | yes | yes |
| Reduce maintenance costs | no | no | no | no | no | no | no | no | no | yes | yes |

Notes:
yes = meets alternative screening criteria
no = does not meet alternative screening criteria
partial = partially meets alternative screening criteria
* Retained for detailed analysis in compliance with NEPA

BESSs were examined in some detail in the electrical system study effort (Power Engineers 1997c). Several alternative locations for a BESS, including Bernice Lake, International, Soldotna, Bradley Lake, and Kasilof substations, were evaluated.

The conclusion of the electrical studies is that the BESS mitigates power swings due to a sudden interruption of power over the existing line, but introduces instability in some cases and increases the likelihood of tripping other existing lines during a disturbance. Potential gains in system performance and increased power transfer are not achievable consistent with the need to increase the secure power transfer limit from 70 MW to 125 MW between the Kenai Peninsula and Anchorage. For a Kenai BESS, transfers greater than 90 MW would result in violations of the ASCC criteria for system stability for a trip of the existing line.

Also, it was noted that installation of a BESS on the Kenai Peninsula and in Anchorage would result in three BESSs on the system (including Fairbanks), and that this may affect the interaction of the controls with the existing static var compensation system and generation controls. There is no comparable industry experience with the operation of an isolated system similar to the Alaska interconnected grid with three BESSs installed and in operation.

Considering the results of the electrical studies, the BESS only partially meets the purpose and need for the Project and was eliminated as an alternative to the Applicant's proposal.

**Demand-Side Management and Energy Conservation**

DSM consists of electric utilities planning, implementing, and monitoring activities designed to encourage consumers to modify their levels and patterns of electricity consumption. While DSM affects only a small percentage of the system load, utilities implement DSM programs to achieve two basic objectives: energy efficiency and load management.

Energy efficiency (or energy conservation) is primarily achieved through programs that reduce overall energy consumption of specific end use devices and systems by promoting high-efficiency equipment and building design. Energy efficiency programs typically reduce energy consumption over many hours during the year. Examples include energy saving appliances and lighting, high-efficiency heating, ventilating and air conditioning systems or control modification, efficient building design, advanced electric motors and drive systems, and heat recovery systems.

Load management programs are designed to achieve load reductions, primarily at the time of peak load. For example, by agreement with their customers, utilities can have direct control over loads that can be interrupted by the utility system operator during periods of peak demand, by directly interrupting power supply to individual appliances or equipment. This method usually involves consumers who allow the utility to periodically interrupt service to water or space heating units during the hours of peak load.

Another type of load management program makes use of interruptible loads. An interruptible load is a load that can be separated from the system during periods of peak load or system disturbances, either by direct control of the utility system operator or by action of the consumer, at the direct request of the system operator. For example, large commercial and industrial consumers are candidates for interruptible load management, depending on the type of business.

Other load management programs that limit peak loads, shift peak load from on-peak to off-peak hours, or encourage consumers to respond to changes in the utility's cost of providing power, also are used. Included are technologies that primarily shift all or part of a load from one time of day to another and also may affect overall energy consumption. Examples include space heating and water heating storage systems, cool storage systems, and load limiting devices in energy management systems.

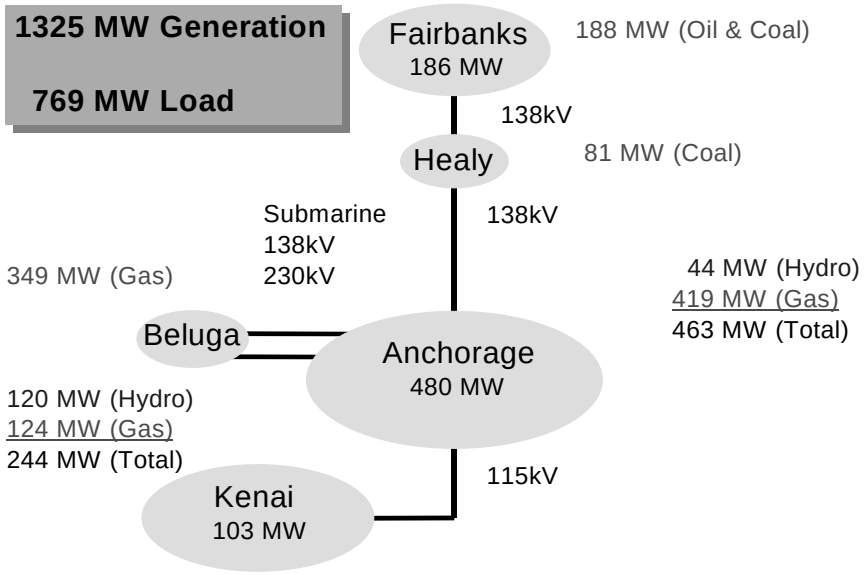
Members of the IPG have implemented energy efficiency and load management programs to varying degrees. HEA, for example, encourages energy efficiency through their water heater rebate program. Matanuska Electric Association has implemented load management programs that allow direct control of customer water heaters, interruptible load, and off-peak space and water heating incentives. GVEA has several Energy$ense programs that address both energy efficiency and load management. AML&P focuses its efforts on energy efficiency through betterment projects at its generating plants and is also developing other energy storage options. CEA and Seward work with their customers to encourage energy efficiency, but have no formal programs.

Energy efficiency and load management programs are important tools that Alaska utilities are using, and will continue to use to manage the demand for and consumption of electricity. However, while valuable, these programs do not address any of the need categories of the Project. These DSM programs focus on managing a very small part of the load on the system, whereas the Project need is for improvements to allow better operational management of the existing interconnected system. Since energy efficiency and load management programs do not address the purpose and need for the Project, DSM was not considered further as an alternative to the Applicant's Proposal.

**New Generation**

As an alternative to constructing a second line from the Kenai Peninsula to Anchorage, adding generation capacity on the Kenai Peninsula and/or in Anchorage was considered. Adding generation capacity would increase the generation resources available to serve load on the system; however, the overall system currently has an excess of generating capacity over electrical load.

Currently, the installed nameplate generation capacity of the Railbelt is about 1,325 MW, as opposed to a winter 2001 projected load of approximately 769 MW as shown on Figure 2-1. Generation capacity as well as electrical load is distributed throughout the Railbelt. As illustrated, Railbelt generation resources currently exceed electrical loads by a factor of nearly two. While new generation resources could be used to enhance reliability and improve system stability during disturbances, generation resources that could be used for this purpose already exist. What is needed is an enhanced ability to use the existing generation resources in the most economical and reliable manner. Following is a description of alternative forms of new generation.




**Railbelt Generation and Loads**

**Figure 2-1**

***Distributed Generation***

Other types of generation, including distributed generation resources, were also considered. Distributed generation resources can be differentiated from centralized generation resources[1] primarily in terms of size and because they are usually installed at or nearby the location that the generated electricity is used. Distributed generation resources come in sizes that range from kilowatt (kW) to a few MW, in contrast to centralized generation resources that come in sizes from 10 MW to over 1,000 MW per site. Distributed generation resource technologies include photovoltaic, energy storage devices, microturbines, solar, wind, and fuel cells. Wind and fuel cells were identified at public meetings as a resource that should be looked at in more detail for the Southern Intertie Project.

[1] Centralized generation resources are traditional large utility electric generation plants such as the Beluga Power Plant and other electric generation plants located throughout the Railbelt.

### *Wind Generation*

Harnessing the wind to provide electric generation resources has been successful in California and in other parts of the world. The addition of wind generation to the Railbelt system would be another way of adding new generation resources to the system. Power can be generated from the wind through the use of large wind turbines or windmills that are sited in areas that exhibit high average wind speeds.

In 1980, a study was completed for the APA to evaluate the wind energy potential in the Cook Inlet area. The study examined wind data from the Pacific Northwest Laboratory (PNL) wind energy database for the area and from the Arctic Environmental Information and Data Center (AEIDC). Based on an analysis of the information provided from the databases, the study concluded that there was no conclusive evidence that large-scale generation of electric energy by MW-scale wind turbines would be a significant viable energy option in the Cook Inlet area.

More recently, in 1998 Chugach commissioned a study to investigate potential sites of wind resources for wind generated power. Fourteen potential locations in the Chugach service territory that could be instrumented for resource data collection were identified. As of May 2001, Chugach has studied 5 of the 14 potential wind generation locations by collecting wind data in the greater Anchorage area. The five locations studied include sites near Portage (two sites), Bird Point (upper and lower bench), Potter Bluff (east of Potter Station House), Fire Island, and the NIKE Site (lower bench).

Data were collected with meteorological instrumentation mounted on a temporary tower. Analysis of the data indicates that the five sites have the potential to produce a total of approximately 100 MW of wind generating capacity. Chugach currently has no specific time line for installation of any wind generation. Permitting, engineering, and cost studies will be required should Chugach decide to pursue wind generation any further.

### *Fuel Cells*

As an emerging technology, fuel cells were considered as an alternative to a second transmission line since early 2000. The addition of fuel cell generation to the Railbelt system would be another way of adding new generation resources to the system.

Fuel cells are power-generating systems that produce DC electricity by combining hydrogen and oxygen in an electrochemical reaction. Fuel cells can be designed to use a variety of fuels, such as natural gas, landfill gas, liquid petroleum gas, propane, and coal gasification. Compared with traditional generating technologies that use combustion processes first to convert fuel to heat and mechanical energy, fuel cells convert the chemical energy of a fuel to electric energy directly, without intermediate conversion processes.

For example, a 1 MW fuel cell plant, consisting of five 200 kW units, has been operating at the U.S. Postal Service Facility near the Anchorage airport. Fuel cell generating units of 200 kW

capacity are commercially available today for about $3,000/kW, as compared to combustion turbine plants that have been and are being constructed for between $450 and $600/kW depending on the size of the unit and other factors.

Additional research and development efforts will likely result in lower costs for fuel cell generation plants, although widespread use of fuel cells for utility generation applications is still several years off. While fuel cell generation plants offer potential for the future, larger size units are not currently commercially available.

The distributed generation alternatives were eliminated from further study because additional generation is not needed.

**Increasing Spinning Reserves**

Spinning reserve is a portion of the operating reserves maintained by utilities. Spinning reserve is unloaded generation, which is synchronized and ready to serve additional demand (NERC 1996).

Spinning reserves instantaneously respond to changes in consumer demand and failures in the generation and transmission system. Spinning reserves improve reliability, but they are often expensive. In order to maintain adequate spinning reserve margins, generation units must be operated partially loaded.

Increasing reliability and improving system stability during disturbances by operating additional generation in a spinning reserve mode could be accomplished at higher system operating costs. These higher costs would be reflected through increased fuel and maintenance expenses, and shorter life for the generating plants. Spinning reserves would need to be increased over present levels in order to enhance the reliability of the system.

One of the reasons the Project is being proposed as a system improvement is to reduce spinning reserve requirements. The alternative of increasing spinning reserves is in contradiction to that purpose. Consequently, increasing the amount of spinning reserves on the system was eliminated as an alternative.

### 2.2.2 Transmission Options

A route selection process was conducted to ensure that the consideration of alternatives would be responsive to both the purpose of and need for the Project and the issues identified through scoping. Initially, alternative routes were identified through the *Southern Intertie Project Route Selection Study – Phase 1 – Environmental Section Report* (Power Engineers, Inc. and Dames & Moore June 1996). During subsequent project scoping, public involvement, agency review, and environmental and engineering analysis, some routes were added and others eliminated from further study. The sequence of routing studies is shown on Figure 2-2. Routing opportunities that

were eliminated during the course of the study area are shown on Figure 2-3. The four primary routes are identified below and are discussed in the following sections:

- Beluga Transmission Corridor
- Quartz Creek Transmission Corridor
- Tesoro Pipeline Corridor
- Enstar Pipeline Corridor

## Beluga Transmission Corridor

Initially, the project study area included the Beluga Power Plant as a possible termination point. An alternative was studied to determine the potential for a submarine crossing of the Cook Inlet between the Kenai Peninsula and the Beluga Power Plant. This alternative was found to be infeasible for the Project because of extreme submarine conditions, the length of the Cook Inlet crossing (18 to 20 miles), and the lack of a suitable landing location along the west side of the inlet. In addition, costs associated with crossing the Cook Inlet at this location with submarine cable would make the Project financially infeasible.

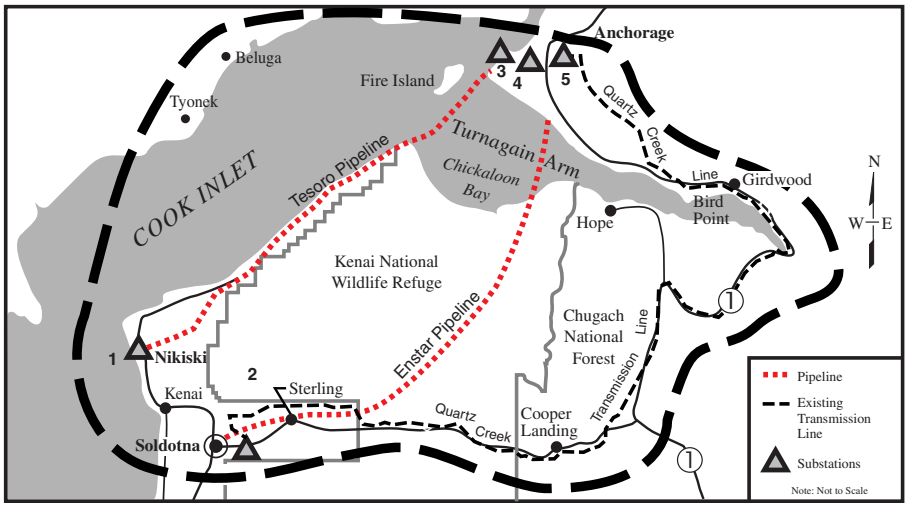
## Quartz Creek Transmission Corridor

### *Upgrade of the Existing Quartz Creek Transmission Line*

The electrical system study effort conducted by Power Engineers (1996a) analyzed the performance of the system by modeling several different upgrade scenarios for the existing Quartz Creek transmission line as an alternative to constructing a second transmission line. The primary benefit to upgrading the existing line would be to increase the power transfer capability between the Kenai Peninsula and Anchorage. Conversion of the operating voltage of the line from 115kV to 138kV or 230kV and the addition of reactive compensation to the line were analyzed. Refer to Figure 2-3.

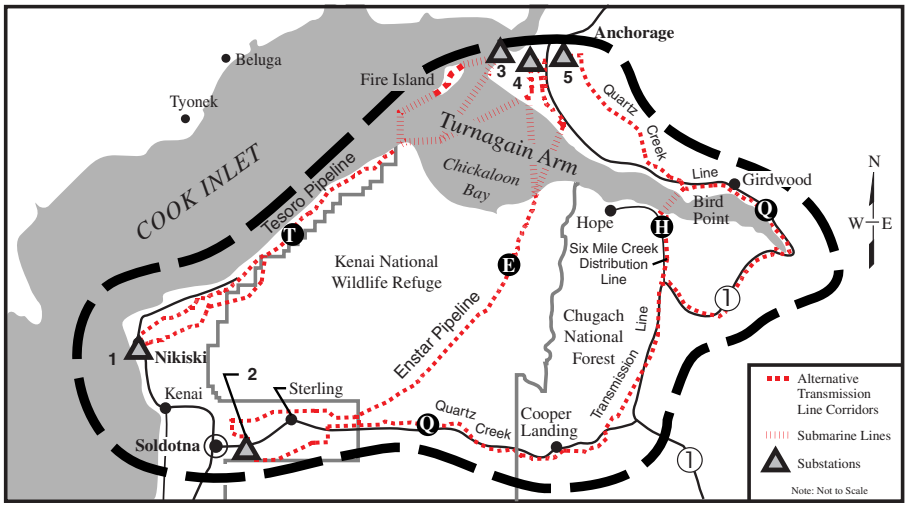
Conversion of the operating voltage from 115kV to 138kV could only increase the power transfer capacity of the existing line by about 20 percent. In addition, most of the line would require reinsulation and the substation transformers at Indian, Girdwood, Portage, Hope, Summit Lake, Dave's Creek, and Quartz Creek substations would require replacement, along with modifications at University and Soldotna substations.

**Initial Regional Route Selection Study Area**



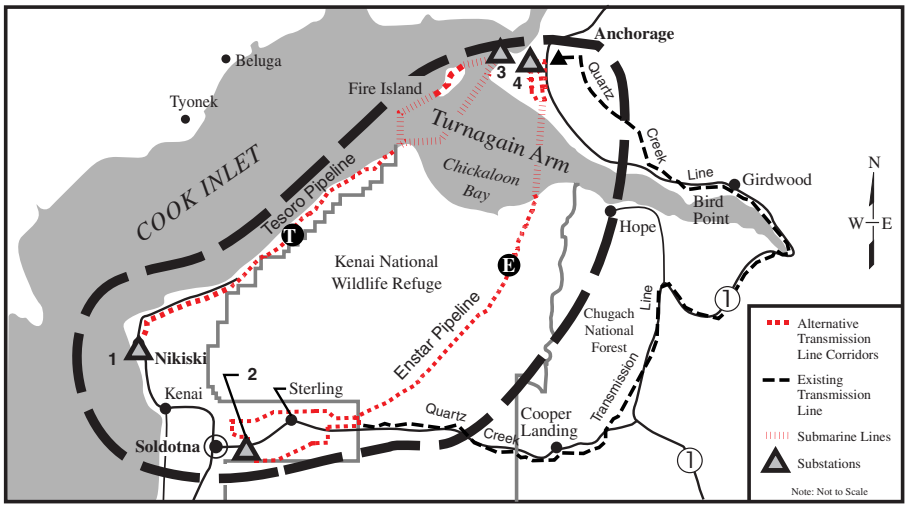

Substations: 1 - Bernice Lake 2 - Soldotna 3 - Point Woronzof 4 - International 5 - University

**Regional Route Selection Study Area and Alternative Study Corridors**




Substations: 1 - Bernice Lake 2 - Soldotna 3 - Point Woronzof 4 - International 5 - University, APA, or Power Plant #2

**EIS Study Area**



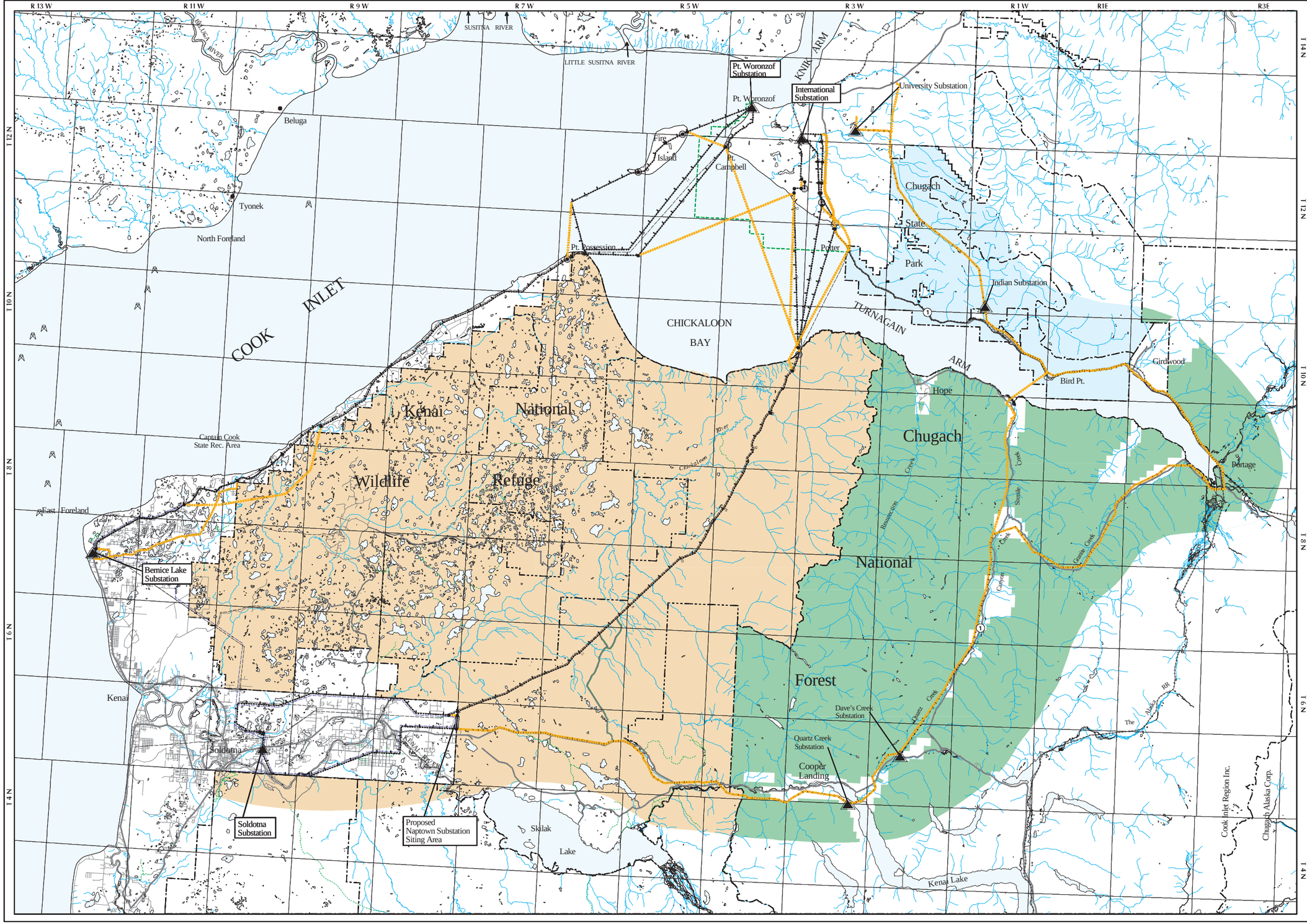

Substations: 1 - Bernice Lake 2 - Soldotna 3 - Point Woronzof 4 - International

**STUDY AREA AND ALTERNATIVE ROUTE PROGRESSION**
**SOUTHERN INTERTIE PROJECT**
**FIGURE 2-2**

# ALTERNATIVE ROUTES ELIMINATED
# SOUTHERN INTERTIE PROJECT
# FIGURE 2-3

## Legend

- Chugach State Park
- Kenai National Wildlife Refuge
- Chugach National Forest
- Private, Borough, or State Selected Lands
- Route Eliminated




Scale in Miles

6 3 1 0 1 3 6

## Source Data / Description:

Municipality of Anchorage (1994).
Chugach National Forest (1995).
Kenai Peninsula Borough (1994).
USGS 1:63,360 and 1:25,000 Quads.

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Increasing the operating voltage of the line from 115kV to 230kV would almost double the power transfer capability of the line. Converting the voltage to 230kV would require replacement of the transformers at the intermediate substations and would also require upgrades to the substations at the endpoints of the line in Anchorage and at the Soldotna Substation. To be capable of carrying 230kV, the entire line would need to be reconstructed by replacing all of the structures. Even though the power transfer capability of the line would be increased, there still would be only one line, and at higher power transfer levels system, stability problems would become worse for an outage of the line.

The addition of either shunt or series compensation also would increase the power transfer capability of the line. Again, the higher power transfer levels would aggravate problems associated with system stability and operation of the system.

While an upgrade of the existing line could increase the power transfer capability, neither of the upgrade alternatives address the issues associated with having only one transmission line interconnection between the Kenai Peninsula and Anchorage. The system stability issues would continue to limit the secure power transfer over the line to 70 MW, the same as the existing situation. The interconnection still would not meet ASCC criteria for single contingency outages. The existing problems associated with system reliability and stability would become worse. An upgrade to the line to achieve higher power transfer levels would aggravate the problems associated with these issues, and would make system-wide blackouts and load shedding more likely for an outage of the line. The reason that system-wide blackouts and load shedding are more likely, and that these problems become worse, is because for system disturbances at transfer levels higher than 70 MW, load shedding is necessary to maintain system stability, resulting in customer outages. If even higher levels of power are transferred across a single line, for example 125 MW (the transfer capacity achieved with the Project), the system will become unstable and it is likely that a system blackout would occur (Power Engineers 1997c). As a result, the alternative of upgrading the existing line was eliminated.

### *Quartz Creek Parallel Route*

The Quartz Creek transmission line corridor between Soldotna and Anchorage was presented as a potential route that would parallel the existing 115kV transmission line right-of-way from the Soldotna Substation on the Kenai Peninsula to one of three substations in Anchorage. The Anchorage endpoint substation options included the University, Anchorage, or AML&P Plant No. 2 substations. This route is referred to as the Portage option. An additional alternative route for the Quartz Creek option was identified which followed Sixmile Creek north to the Turnagain Arm crossing near Bird Point, as shown on Figure 2-3. This route is referred to as the Sixmile Route. The key issues that led to eliminating the Quartz Creek Route from further study are discussed below.

Reliability/Purpose and Need

A second line parallel to the existing line would increase the power transfer capacity of the system between Anchorage and the Kenai Peninsula. However, the second parallel line would be subject to the same outage events as the existing line, including weather and avalanche risks. Consequently, reliability would not be enhanced and energy transfer capability would remain limited by the current operational constraints.

By failing to meet the need criteria for increased reliability, the ability to transfer power would be adversely affected, even though the power transfer capacity could be improved by using the Quartz Creek Route. As a result, other need criteria, including using the most economic generation mix to reduce costs, improving system stability during disturbances, and reducing the requirements for spinning reserves, would not be fully met.

Chugach State Park

The existing 115kV transmission line crosses 26.3 miles of Chugach State Park, traversing Powerline Pass to Indian, and then generally paralleling the Seward Highway National Scenic Byway to Girdwood. The Quartz Creek Route alternative would parallel this existing line.

In 1973, Chugach State Park applied for funding assistance from the U.S. National Park Service (NPS) under the Land and Water Conservation Fund Act (LWCFA). That action placed the entire park under the legal protection of Section 6(f)(3) of the Act, which states that grant-assisted areas are to remain forever available for public outdoor recreation use or be replaced by lands of equal market value and recreation usefulness. The existing 115kV line predates the park and funds assistance. Alaska Department of Natural Resources - Division of Parks and Outdoor Recreation staff have indicated that they perceive an additional overhead transmission line as a conversion of use and a double-circuit configuration of the existing facilities as a significant change in the visual aesthetics of the property. The Division of Parks opposes altering the existing facility and, therefore, will not support a request for conversion of use to the NPS for either alternative.

A conversion of use for the existing line would also require an amendment to the Federal Energy Regulatory Commission license, under which this line was originally constructed. With the known opposition of the Division of Parks, it is very unlikely that such an amendment would be approved.

Chugach National Forest

During the route selection process, the U.S. Forest Service requested that rather than establishing a second transmission line in the Chugach National Forest parallel to the existing line, the existing and proposed lines be double-circuited on the same structure. This mitigation would

address both right-of-way and visual impacts on the Chugach National Forest but the result would be an inherent reduction in reliability from having both lines on the same structure.

Avalanche Hazards

Avalanche damage and outages to the Quartz Creek transmission line are well documented as an ongoing hazard. As such the same hazard would apply to the new line as well, if it were constructed along any of the Sixmile or Portage routing options. Avalanche hazard areas are shown on Figure 2-4.

The Quartz Creek transmission line has sustained significant avalanche damage numerous times throughout its life. Most recently in 2000, the line sustained significant damage, causing a power outage in the Girdwood area for about one week while repairs to the line on both sides of the community were completed. Because of this, and other avalanche damage, restoration of the entire Quartz Creek transmission line between Anchorage and the Kenai Peninsula took more than four weeks. Extended outages to the existing line have occurred because of avalanches in the Bird Flats area, between Girdwood and Hope Junction, as well as in the Summit Lake area. Historic records indicate that during an 18-year period from 1971 to 1988 the line was hit and severely damaged by avalanches on 11 occasions in 6 different areas, for an average of at least once every 1.6 years. The longest period of time without interruption was eight years while the least was less than one year.

The Alaska Mountain Safety Center assigned levels of risk to each span or structure located near the avalanche paths studied along the Quartz Creek Route in 1991, as follows:

- High Risk—five or more large, potentially destructive avalanches during a 50-year period
- Moderate Risk—one to four large, potentially destructive avalanches during a 50-year period
- Low Risk—the structure or span is capable of being hit, either frequently or infrequently with no damage or destruction

During the three-year period from 1989 to 1991, CEA reduced the overall frequency of risk exposure faced by the line by implementing mitigation in many of the areas of highest hazard (i.e., in paths that posed the greatest frequency of destructive threat). The measures included relocating structures to areas of less exposure, protecting structures with reinforced splitting wedges, increasing structure heights and thus conductor spans, installing double-dead ends and breakaway insulators, and designing structures to minimize damage. As a result, most of the remaining hazard (frequency) is rated as moderate, as shown in Table 2-2.

| TABLE 2-2<br>QUARTZ CREEK 115kV TRANSMISSION LINE AVALANCHE RISK EXPOSURE 1991 | | | | |
|---|---|---|---|---|
| | Risk Exposure – Number of Structures or Spans | | | |
| Component | Low | Moderate | High | Total |
| Structures | 31 | 56 | 1 | 88 |
| Spans | 65 | 49 | 3 | 117 |

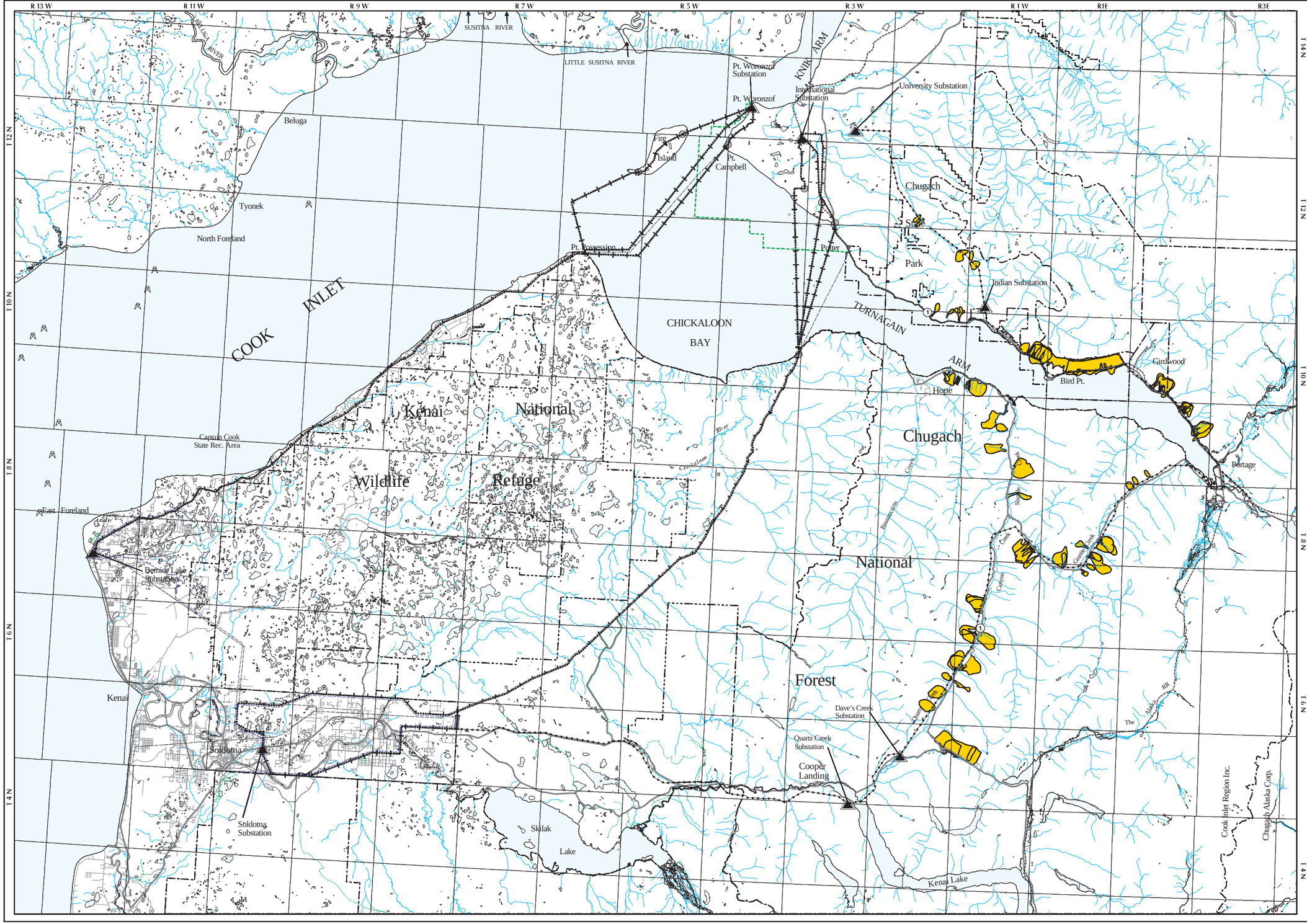
Damaging avalanches affecting the Quartz Creek transmission line between 1971 and 2000 are tabulated in Table 2-3. As shown, destructive avalanches have damaged the line in 7 of the last 30 years (1971 to 2000), an average of every 4.3 years.

| TABLE 2-3<br>AVALANCHE DAMAGE TO THE QUARTZ CREEK LINE | | |
|---|---|---|
| General Location | Avalanche Path | Year of Damage |
| Powerline Pass Path/Campbell—Indian Creek area | A-3 | March 1979 |
| Powerline Pass Path/Campbell—Indian Creek area | A-3 | December 1988 |
| Five Fingers/Bird Creek—Girdwood area | B-4 | 1980 (2 events) |
| The Dump Path/Bird Creek—Girdwood area | B-5 | 1980 |
| Bird Flats No. 6/ Bird Creek—Girdwood area | B-7 | 1976 |
| Bird Flats No. 6/ Bird Creek—Girdwood area | B-7 | 1988 |
| Bird Flats No. 7/ Bird Creek—Girdwood area | B-8 | 1979 |
| Bird Flats No. 7/ Bird Creek—Girdwood area | B-8 | 1988 |
| Bird Flats No. 7/ Bird Creek—Girdwood area | B-8 | February 2000 |
| Kern Creek, Girdwood to Portage area | C-3 | February 2000 |
| Peterson Group/Girdwood to Portage area | C-9 | April 1988 |
| Gold Pan/Turnagain East Group, Portage to Granite Creek area | D-5 | 1971 |
| Gold Pan/Turnagain East Group, Portage to Granite Creek area | D-5 | 1975 |
| Dave's Creek Path/Turnagain East Group, Portage to Granite Creek area | D-6 | 1971 |
| Dave's Creek Path/Turnagain East Group, Portage to Granite Creek area | D-6 | 1975 |
| Bertha/Turnagain East Group, Portage to Granite Creek area | D-8 | 1971 |
| Bertha/Turnagain East Group, Portage to Granite Creek area | D-8 | 1975 |
| Fresno Group, Hope Cutoff to Quartz Creek area | F-1 to F-4 | February 2000 |
| Lower Summit No. 1, Hope Cutoff to Quartz Creek area | F-5 | February 2000 |
| Summit Lake S.P. No. 7/Summit Group, Hope Cutoff to Quartz Creek area | F-8 | January 1980 |
| Summit Lake S.P. No. 6/Summit Group, Hope Cutoff to Quartz Creek area | F-9 | January 1980 |
| Summit Lake S.P. No. 6/Summit Group, Hope Cutoff to Quartz Creek area | F-9 | 1988 |
| Summit Lake S.P. No. 5/Summit Group, Hope Cutoff to Quartz Creek area | F-10 | May 1988 |
| Summit Lake S.P. No. 5/Summit Group, Hope Cutoff to Quartz Creek area | F-10 | January 1980 |
| Summit Lake S.P. No. 4/Summit Group, Hope Cutoff to Quartz Creek area | F-11 | January 1980 |
| Summit Lake S.P. Nos. 2 and 3/Summit Group, Hope Cutoff to Quartz Creek area | F-12 | January 1980 |
| "37-Mile"/Avalanche Acres Group, Dave's Creek to Moose Pass | G-4 | January 1980 |
| Source: Alaska Mountain Safety Center (1991); Chugach Electric Association (2000) | | |

# AVALANCHE HAZARD AREAS
# SOUTHERN INTERTIE PROJECT
# FIGURE 2-4

## Legend

Avalanche Hazard Areas




## Source Data:

Municipality of Anchorage (1994).
Chugach National Forest (1995).
Kenai Peninsula Borough (1994).
USGS 1:63,360 and 1:25,000 Quads.

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The Summit Lake Group of avalanche paths would be crossed by any new transmission line constructed along the existing Quartz Creek Route (both the Sixmile or the Portage routes). A review of Summit Lake avalanche activity over the last few years illustrates that avalanche activity can be high, regardless of whether or not damage to the transmission line actually occurs. The Alaska Department of Transportation and Public Facilities (ADOT/PF) regularly closes the highway at Summit Lake and shoots potential avalanches to reduce the risk of a destructive avalanche. Avalanche magnitudes are estimated by ADOT/PF. Table 2-4 tabulates the number of avalanches that ran greater than 50 percent of the path, and represents the number of avalanches that had the potential to or did cause damage to the line. Data for the years following 1997 is not yet available. However, there has been a lot of avalanche activity at the Summit Lake Group. For example, in 2000 major avalanches crossed both the transmission line route and the Seward Highway in four locations.

**TABLE 2-4**
**SUMMIT LAKE GROUP**
**AVALANCHES INVOLVING 50 PERCENT OR MORE OF THE PATH**

| Year | Number of Avalanches | Transmission Line Damaged |
|---|---|---|
| 1986 | 4 | |
| 1987 | 0 | |
| 1988 | 12 | Transmission line hit and damaged three times |
| 1989 | 6 | |
| 1990 | 16 | Transmission line hit |
| 1991 | 7 | |
| 1992 | 3 | |
| 1993 | 5 | Transmission line avalanche deflector hit |
| 1994 | 9 | |
| 1995 | 4 | |
| 1996 | 2 | |
| 1997 | 3 | |
| Average per year | 5.9 | |

Source: Alaska Department of Transportation (1998)

The Alaska Mountain Safety Center studies of the existing Quartz Creek transmission line produced recommendations that resulted in the construction of upgrades to the existing structures along the line to mitigate the potential damage to the lines from avalanches. The line was reconstructed in three of the highest hazard areas (paths which pose the greatest frequency of destructive threat) including Bird Flats (1.6 miles - 1988), Peterson Creek (1.2 miles - 1989), and Summit Lake (1.0 mile - 1991). Where possible, structures were relocated and structure height was increased to attempt to mitigate damage from avalanches. At Bird Flat, one angle structure remains directly in the avalanche path, because there is no alternative location for the structure. The line remains routed along the Seward Highway with virtually no alternative locations available. At Peterson Creek, structures were relocated away from known avalanche paths and breakaway links were installed at conductor attachment points in locations where exposure to avalanches could not be avoided. At Summit Lake, structures were replaced with higher steel structures, and wooden deflectors were installed at structures located in known avalanche paths.

It is hoped that these reconstructed sections will reduce the damage to the line from avalanche blasts when they occur; however, the reconstructed sections are not capable of withstanding all avalanche blasts. While most of the remaining hazards along the line are rated as moderate, the only difference between high hazard and moderate hazard is one of frequency. Avalanches in areas rated as a moderate hazard can cause just as much damage to the line as those occurring in areas rated as a high hazard (Alaska Mountain Safety Center, Inc. 1991).

Avalanche Mitigation

As part of the alternative screening process, several options for construction of a new line parallel to the existing Quartz Creek transmission line were evaluated to address these issues. However, there are numerous avalanche paths along the existing line route that also would exist along any parallel route. An alternative to paralleling the existing route around the end of Turnagain Arm and through Turnagain Pass (Portage) would be to cross the Turnagain Arm from the Indian area to Sixmile Creek with submarine cable, and then follow the existing distribution line right-of-way south to Hope Junction (Sixmile). The Sixmile Route avoids 11 avalanche hazard areas located along the existing line route between Indian and Hope Junction. However, the Sixmile route does cross one additional avalanche hazard area in the Sixmile Creek area.

The Summit Lake avalanche area crossed by the Quartz Creek Route is about 8 miles long. As noted above, upgrades to the structures over a 1-mile section of this area were completed in 1991. As part of the design process for this upgrade, the velocity and density of the various layers of a typical avalanche (snow, snow debris, airborne snow, and air blast) were estimated to define the expected loading on the wire and at different heights along the structures. Steel pole structures were designed for the estimated loads. Because structures could not be located between avalanche paths, wooden deflectors were installed around the new steel poles to redirect the avalanche. The deflectors are built with traditional transmission line material consisting primarily of wooden poles and crossarms. Summit Lake avalanches can be very large and design of the deflectors was based on the "normal" avalanche[2]. The design of the deflectors is based on a "head-on" avalanche, so they face uphill. Some of the avalanche paths along Summit Lake are quite long and an avalanche can easily turn during its trip to the bottom. The effectiveness of the deflectors has not been truly tested, as no large avalanches have struck the line since they were installed.

Other design approaches to mitigate avalanche damage have been constructed. For example, large avalanches at Peterson Creek can extend well into Turnagain Arm, and there are no reasonable structure locations that are not vulnerable. In 1989, new dead-end structures were installed at the edges of the "normal" avalanche runs. These dead ends are intended to break away during an avalanche to limit the line damage to the avalanche path only. This is an unproven concept as the dynamic forces of avalanches even in their historical paths are difficult to estimate. The dead ends may or may not contain the damage. Also, an avalanche that is larger than "normal" could overrun the dead ends.

[2] Design parameters were based on "Avalanche Stagnation – Pressure Calculations, Chugach Electric Association Summit Lake Transmission Line," prepared for Dryden & LaRue, Inc. by Arthur I. Mears, PE, Inc., July 1989.

Another design approach would be to build the line strong enough to withstand the forces generated by an avalanche. While not in the immediate Project area, in Thompson Pass north of Valdez this concept was tested with a large avalanche in 1988. The "School Bus Avalanche" swept away a 10,000-pound steel X-tower and carried it 500 feet. The avalanche was estimated to be traveling 113 miles per hour with a mass of 44 to 88 million pounds when it hit the structure. A very strong, 73,000-pound tensile strength conductor was used in this line segment over the avalanche area. Once the first tower was knocked down, the strong conductor proceeded to damage six additional structures. The attempt to build structures stronger than the avalanche did not work and is seldom appropriate for large avalanches (Mears and Fesler 1989).

Another method to mitigate damage to the line and reduce the number of outages due to avalanches would be to underground the line across avalanche paths. Below are advantages and disadvantages to undergrounding the line across the avalanche paths.

**Advantages:**

1. Buried cable will normally not be affected by avalanches that run on the snow.

**Disadvantages:**

1. Typical colluvial soils in avalanche run-out areas may not be consolidated and can be subject to slope stability problems.

2. Incised creeks will be very difficult, if not infeasible, to bury cable across due to the exposed bedrock and steep side slopes.

3. If damage does occur to a buried line, it is much more difficult to locate the problem than for an overhead line.

4. If damage does occur to a buried line, it is much more difficult to repair than for an overhead line.

5. If the damage occurs early in the winter, the underground line could be out of service for up to six months until the following spring, due to the difficulty and safety hazards associated with accessing a buried facility in an avalanche area covered with snow and frozen soil. The addition of a spare cable would not be of value because the close proximity of the cables in an underground installation would make it likely that the forces causing the failure would impact all cables.

6. Inventory costs for maintenance materials are much higher for an underground line than an overhead line.

7. Late spring avalanches can excavate soils at lower elevations and possibly dig up the cable. This has occurred in the past with a pipeline in the Bird Flats area.

8. Long underground runs would require pull boxes, located partially above ground, which would be exposed to any ground surface events.

The possibility of a damaging event to the underground facility increases with the length of exposure across avalanche paths, and the number of paths crossed. The Sixmile Route would cross a total of seven avalanche paths with underground cable, while the Portage Route would cross a total of 18 avalanche paths with underground cable. Based on historical data, a destructive avalanche can be expected to occur an average of about every five years. Placing the line underground should increase the interval between damaging events, but will not eliminate damaging events. For the Sixmile Route, damage could occur to one of the seven underground segments an average of every 15 years. The Portage Route nearly triples the number of avalanche paths crossed, exposing the underground lines to some of the most destructive avalanche paths on the Quartz Creek Route. The average frequency of a damaging event would increase to once every five to six years to one of the 18 underground segments. Each occurrence of damage to the underground cables due to avalanche could result in an outage of the line for up to six months. The long outage duration from avalanche is due to lack of site access, remote location, and the facility covered with snow and frozen soil. Repairs to pull boxes/buried cable in avalanche paths are impractical and dangerous during the winter and so the circuit would remain out of service until the spring or summer for repairs.

A six-month outage duration to the line for repairs to the underground facility is unacceptable from a system operations viewpoint. While for comparison purposes installation of such a facility was considered, it would be imprudent to do so. It would be preferable from an operating standpoint and less costly overall to construct an overhead line along the Quartz Creek Route, and fix it when damage from avalanches occur.

### *Sixmile Creek to Anchorage-Submarine*

This alternative was presented as an option to utilize the existing Quartz Creek transmission line corridor, minimize avalanche exposure, and avoid Chugach State Park. The distance involved to reach the closest Anchorage submarine landing point from Sixmile Creek would be approximately 18 to 20 miles. This would increase costs of the project substantially, adding to the reasons for elimination of the Quartz Creek Route.

### *Restore or Remove Cooper Lake Hydroelectric Site*

Public and agency comments questioned the relationship of the Cooper Lake Hydroelectric facility to the Project. A major overhaul and upgrade to the power plant was completed in March 2001. There are no improvements planned for the transmission line between the power plant and the Quartz Creek Substation. The additional power output of about 2 MW will have no discernible impact on the existing transmission system or this Project. Additional changes to the Cooper Lake Hydroelectric facility are not planned as a result of this Project, nor is the Project required for the changes that have occurred at Cooper Lake.

**Tesoro Pipeline Corridor**

In 1975 the Tesoro Alaska Petroleum Company completed construction of a 70-mile-long, 10-inch-diameter pipeline across the northern end of the Kenai Peninsula and under Cook Inlet to the Port of Anchorage. This existing corridor is one of the possible routing alternatives considered for this project.

The primary routing opportunity for the Tesoro Route between the Bernice Lake Substation and Captain Cook SRA is along the North Kenai Road. Other alternatives studied included a route parallel to the Tesoro pipeline that would avoid a roadside route, and a new overland route that would be located within the KNWR that would avoid the Captain Cook SRA. As described below, these alternatives would result in significant impacts that could be mitigated by utilizing the Kenai Road route.

Route options that were studied and eliminated along the Tesoro pipeline corridor are shown on Figure 2-3, and are discussed below.

***Tesoro Pipeline to Captain Cook SRA***

This alternative route parallels the Tesoro pipeline from Nikiski to Captain Cook SRA. This corridor already contains approximately four underground pipelines, buried telecommunication cable, and overhead distribution lines, which would present potential construction and right-of-way conflicts. Potentially significant impacts on viewers from concentrated residential development, property conflicts, and aviation safety led to the recommendation that this alternative be eliminated from further consideration.

***Captain Cook SRA Avoidance Route***

This alternative does not parallel any existing linear features as it bypasses the Captain Cook SRA by crossing into the KNWR. The management policy of this part of the refuge is designated Moderate Management. This category manages areas easily accessible to the public and manipulates a significant amount of habitat to benefit populations of selected species. Although some natural processes are altered, habitat management is designed to maintain natural landscapes (KNWR 1985a). The USFWS expressed concern about establishing a new corridor in this area and the potentially significant visual impacts it could have on the Stormy Lake Beach area. The combined effect of management policy, potential visual impacts, potential biological impacts on trumpeter swan nesting sites, and right-of-way limitations throughout the KNWR resulted in elimination of this alternative from further consideration.

### *Pt. Possession Village to Fire Island*

This alternative would diverge from paralleling the Tesoro pipeline and transition to a submarine cable heading to Fire Island. This route would pass through an identified historical and cultural site of the Pt. Possession Group. As a result of potentially significant cultural resource impacts, this route was eliminated from further study.

### *Tesoro Anchorage - Alternative Routes*

- Pt. Possession to Enstar with overhead line through the KNWR
- Pt. Possession to Enstar using submarine cable
- Pt. Possession to Enstar following the beach and coastline

These three alternative routes were proposed to avoid the extreme marine environment located north of Pt. Possession by traversing east through the KNWR or Chickaloon Flats. However, the overhead line alternative through the KNWR would cross through approximately 5 miles of the Kenai Lowland Wilderness Unit requiring an act of Congress to approve the route. It also would cross 12 miles of lands designated Minimal Management, which are areas recommended for future wilderness designation and are currently managed to maintain pristine conditions according to the KNWR Comprehensive Conservation Plan of 1985. Trenching the submarine cable across the mudflats would alter the hydrologic properties of stream channels in the Chickaloon Bay estuary, a major breeding ground for waterfowl and spawning habitat for anadromous fish (a directional bore in this area is not feasible due to the length of the crossing of Chickaloon Bay from west to east). This same route would also cross 3 miles of the Pt. Possession Group Native allotment and involve Section 22(g) of the Alaska Native Claims Settlement Act (ANCSA - see Section 4.6). Overall it would increase the length of the Tesoro Route by approximately 20 miles. As a result of no existing linear features to follow in this part of the refuge, additional regulatory approvals, increased cost, and degree of reasonableness, this alternative route was eliminated from further consideration.

The two other route options suggest locating the submarine cable in the Chickaloon Flats tidal areas or adjacent to the coastline in order to reach the Enstar Route, or at least avoid the extreme marine environment north of Pt. Possession. The increased distance for submarine cable, 24 to 28 miles, along with construction practicality in this area, severely constrains this option. Increased exposure to ice scour, tidal fluctuations, and boulder fields also constrain the feasibility of construction and operation. As a result of environmental and regulatory issues, increased distance, increased cost, and construction practicality, these two options were eliminated from consideration.

***Submarine Crossings – Turnagain Arm***

Moose Point to Fire Island Following along the Moose Point Shoal

This route was presented as an option to avoid the extreme marine environment north of Pt. Possession by following a shoal off the western coastline of the Peninsula from Moose Point to Fire Island. Increased distance of submarine cable (22 to 23 miles) and associated costs, boulder fields, and strong tidal currents all contributed to this route being eliminated from consideration.

Turnagain Arm Causeway

This alternative suggests that the transmission line be attached to a causeway that would connect Pt. Possession to Anchorage. This alternative would avoid a submarine cable crossing of the Turnagain Arm and minimize any problems associated with submarine cable. At this time, the proposed causeway is a conceptual plan that has been in existence since the mid-1970s. There is no funding associated with the proposed causeway and no alignments or designs delineated. Based on these factors this alternative route was eliminated from further consideration.

Pt. Possession to Klatt Road Landing

A submarine crossing to the Klatt Road landing in Anchorage was eliminated because the distance was not considered economical.

Fire Island to Pt. Campbell

The submarine crossing between Fire Island and Pt. Campbell was eliminated because of the availability of the crossing from Fire Island directly to the Pt. Woronzof Substation. Impacts to Kincaid Park in Anchorage would be avoided by routing directly to the Pt. Woronzof.

**Enstar Pipeline Corridor**

The primary routing opportunities for the Enstar Route out of the Soldotna Substation include a 69kV line that proceeds through the Funny River area south of the Kenai River, and a 115kV line that traverses the KNWR boundary north of the Sterling area.

Both of these options join together in the proposed Naptowne Substation siting area with the existing Enstar pipeline corridor. This corridor contains two Enstar natural gas pipelines that traverse the KNWR in a 50-foot-wide right-of-way from the Soldotna area north to Chickaloon Bay. This route would parallel the pipeline and its associated access trail for 38.3 miles.

Route options that were studied and eliminated along the Enstar pipeline corridor are shown on Figure 2-3, and are discussed below.

### *Bury Line through KNWR*

Undergrounding the transmission line for the entire length through the KNWR has been suggested as a way to minimize visual and environmental impacts. The relative cost of underground is about four to five times more expensive than the cost to construct an overhead line. Unlike an overhead transmission line, an underground transmission line requires reactive compensation at the ends of the underground line segment and at intermediate stations. At least three reactor stations would be required along the 38.3-mile route length through the KNWR. Reactor stations would appear similar to a typical substation, with the equipment contained in an aboveground fenced and graveled area. Access to the reactor station would be required for periodic equipment maintenance. Concrete vaults for splicing the cable would be required at about 2,000-foot intervals throughout the route, depending on the terrain. Placing the line underground through the KNWR would add about $70 million to the cost of the Project and would make the Project financially infeasible.

### *Burnt Island to Pt. Campbell*

A submarine crossing to Pt. Campbell in Anchorage was eliminated because the distance was not considered economical.

### *Burnt Island to Potter Along Enstar Pipeline*

A submarine crossing to Potter was eliminated because of routing conflicts along the Seward Highway and Alaska Railroad (see below).

## Anchorage Area Routes

Routes that were eliminated in the Anchorage area are discussed below.

### *Potter to Rabbit Creek Interchange*

These alternatives would parallel the Old Seward Highway from the Potter Section House to Rabbit Creek Interchange or parallel the New Seward Highway and Alaska Railroad from the same endpoints. Potentially significant impacts on visual resources and biological resources were identified along this route in addition to right-of-way limitations. Potential visual impacts would result from extensive residential development in the Rabbit Creek/Hillside area. Biological concerns centered around Potter Marsh and its associated waterfowl nesting and staging areas.

Right-of-way limitations are encountered when paralleling the roads or the railroad as a result of engineering constraints.

### *New Seward Highway*

This alternative would parallel the New Seward Highway from Rabbit Creek Interchange to International Airport Road. Siting constraints were identified by ADOT/PF, along with constraints for construction and maintenance activities. As a result of right-of-way limitations, this alternative was recommended for elimination.

### *Alaska Railroad/Ocean View Bluff*

This alternative would parallel the Alaska Railroad from Rabbit Creek Interchange to Ocean View Park. Representatives of the Alaska Railroad identified slope failure potential and erosion as constraints for this area. In addition, right-of-way limitations as a result of adjacent residential development were identified. The combined effect of these constraints resulted in elimination of the alternative from further consideration.

## Underground Line Alternatives

Underground transmission has been proposed only where required by regulations (for example, through Captain Cook SRA and/or to avoid hazards that would be associated with an overhead line (near an airport). The reason for this is that the cost of underground transmission is four to five times the cost of an overhead line. Operational problems are greater and the duration of outages is normally longer. This is because when an outage to an underground line occurs, determining the cause and location of the damage, the replacement parts needed to repair the line and actually repairing the line takes much more time than for an overhead line. Repairs to an underground line are more expensive to fix as well. In addition, if an underground line is damaged during the winter, the presence of snow and frozen soil will increase the length of time required and degree of difficulty to repair the facility. Operationally, overhead lines are preferred.

## Alternative Voltage

The appropriate operating voltage for a second transmission line interconnection between the Kenai Peninsula and Anchorage has been studied on several occasions (AEA 1991; Power Engineers 1996a). Operating voltages of 138kV and 230kV were studied, because both of these voltage levels are used in the Alaska interconnected system.

Each of the studies that considered the two voltage levels reached the same conclusions. Both the 138kV and 230kV alternatives exhibited similar performance for the expected steady state power transfers and system disturbance analyses. The additional power transfer capability offered by

230kV is not required for the power transfer levels projected during the life of the Project, based on the current projections of load growth and generation additions. The only advantage exhibited by a 230kV voltage level was slightly reduced transmission line losses. The 230kV alternative has the disadvantage of requiring larger and more expensive equipment than the 138kV alternative. The substantially higher cost of the 230kV facilities (Power Engineers 1996a) makes the 230kV operating voltage alternative uneconomical, when compared to the 138kV. Therefore, an operating voltage of 138kV is proposed for the Project and an alternate voltage level was eliminated from further study.

## 2.3 ALTERNATIVES EVALUATED IN DETAIL

Three alternatives were carried forward and studied in detail: the no-action alternative; the Applicant's proposal of constructing a new transmission line between Soldotna and Anchorage along the Enstar pipeline route; and the alternative of constructing a new transmission line between Nikiski and Anchorage along the Tesoro pipeline route.

The following steps were used to develop the Enstar and Tesoro routes that were retained for detailed study:

1. Individual segments or "links" were established along the routes. Route options were organized by groups of links and were assigned letters. These route options and link codes can be found on the General Reference Map (Volume II, Maps).

2. The route option codes were assigned to three geographic regions (Kenai Lowlands, Turnagain Arm, and Anchorage area) and assigned letters. These lettered link combinations or route options can be combined to form entire alternative routes.

Table 2-5 provides a list of each alternative route within the three regions. Figures 2-5 and 2-6 illustrate the alternative route options and highlight the Applicant's proposed route. A schematic diagram that illustrates how each alternative route was developed from the lettered link combinations or route options is presented in Figure 2-7.

Therefore, the analysis that is presented in Chapter 3 and summarized in this section will focus on the following routing options. Routing across the Kenai Lowlands will consist of Tesoro Option A and Enstar Options E-North, E-South, and F. The Turnagain Arm crossings will consist of Tesoro Options B, C, and D and Enstar Options H, I, and G. The Anchorage area routes will consist of Tesoro Option N and Enstar Options J, K, and M.

**ALTERNATIVES STUDIED IN DETAIL**
**SOUTHERN INTERTIE PROJECT**
**FIGURE 2-5**

## Legend

- Applicant's Proposed Route
- Enstar Route Options
- Tesoro Route Options
- Chugach State Park
- Kenai National Wildlife Refuge
- Chugach National Forest
- Private, Borough, or State Selected Lands

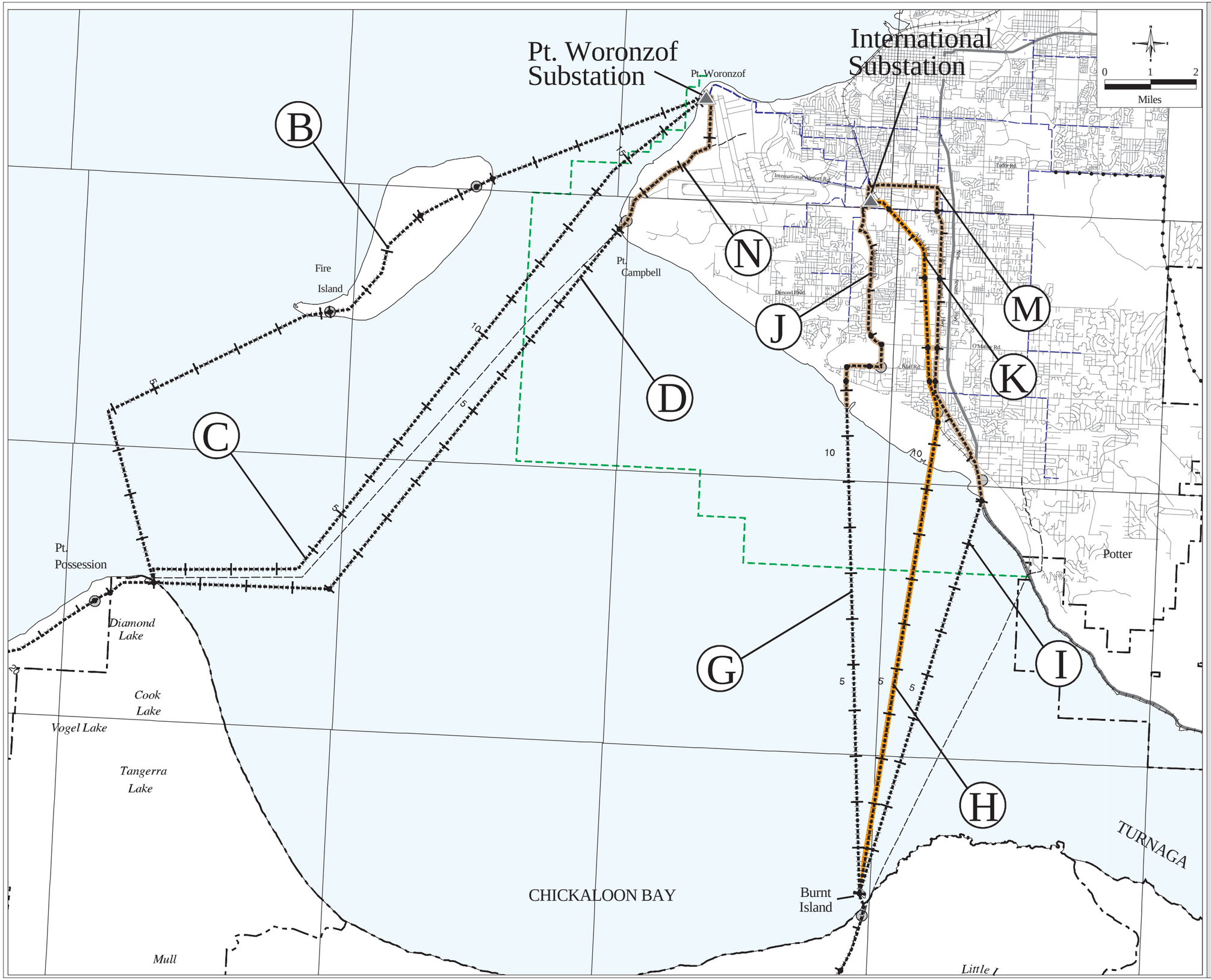
Scale in Miles: 6 3 1 0 1 3 6

Base Map Sources:
Municipality of Anchorage (1994).
Chugach National Forest (1995).
Kenai Peninsula Borough (1994).
USGS 1:63,360 and 1:25,000 Quads.

Contour Interval: 200 Feet
Contour Labeling in Feet

09/12/01

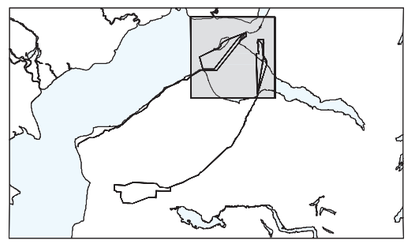
**ANCHORAGE AREA ALTERNATIVE ROUTES SOUTHERN INTERTIE PROJECT FIGURE 2-6**




## Legend

- Applicant's Proposed Route (Enstar Route)
- Anchorage Area Route Options

| Route Option | Links |
|---|---|
| J | A1, A3, A2, A4, A5 |
| K | A6, A7, A8, A9, A10 |
| M | A11, A13, A14, A15, A16 |
| N | T18 |



Base Map Sources:
Municipality of Anchorage (1994).
Chugach National Forest (1995).
Kenai Peninsula Borough (1994).
USGS 1:63,360 and 1:25,000 Quads.

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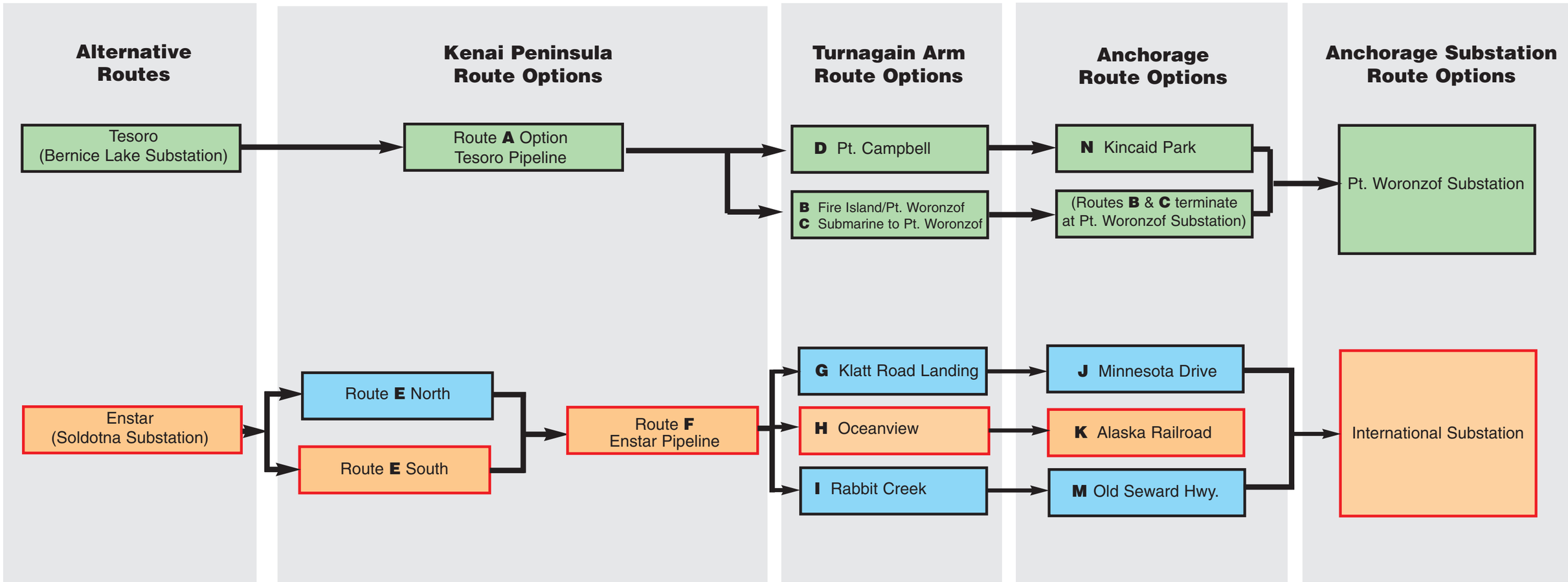



Applicant's Proposed Alternative

Tesoro Route Options

Enstar Route Options

**ALTERNATIVE ROUTES AND SUBSTATION OPTIONS**
**SOUTHERN INTERTIE PROJECT**
**FIGURE 2-7**

**TABLE 2-5**
**ALTERNATIVE ROUTE SEGMENTS**

**Tesoro Alternative**

- Kenai Lowlands Region
  - Route A - Bernice Lake to Pt. Possession (Links T1, T2, T3, T4, T5, T6, T7, T8, T9)
- Turnagain Arm Region
  - Route B - Pt. Possession to Pt. Woronzof via Fire Island (Links T10, T11, T12, T13, T14)
  - Route C - Pt. Possession to Pt. Woronzof submarine (Link T18)
  - Route D - Pt. Possession to Pt. Campbell (Links T16, T17)
- Anchorage Area
  - Route N - Pt. Campbell to Pt. Woronzof (Link T18)

**Enstar Alternative**

- Kenai Lowlands Region
  - Route E North - Northern Soldotna Alternative (Links E1, E2, E3, E4)
  - Route E South - Southern Soldotna alternative (Links E5, E6, E7)
  - Route F - Enstar to Chickaloon Bay (Links E8, E9, E10)
- Turnagain Arm Region
  - Route G - Chickaloon Bay to Klatt Road (Link E11)
  - Route H - Chickaloon Bay to Oceanview Park (Link E12)
  - Route I - Chickaloon Bay Rabbit Creek (Link E13)
- Anchorage Area Alternatives
  - Route J - Klatt Road to International Substation via Minnesota Drive (Links A1, A2, A3, A4, A5)
  - Route K - Oceanview to International Substation via Alaska Railroad (Links A6, A7, A8, A9, A10)
  - Route M - Rabbit Creek to International Substation via Old Seward Highway (Links A11, A13, A14, A15, A16)

**Other Routing Options in the Anchorage Area** (see Volume II, Appendix A for more information regarding these routes)

Any of the routing options across Turnagain Arm or within the Anchorage area have the potential to be selected and ultimately approved for construction. However, in the Anchorage area, a comprehensive evaluation of every potential combination of routing options will include redundant information that can be confusing for the reader. Therefore, the primary route options have been discussed in detail in the text of this document. The four connecting links along with the potential routing combinations these links provide are identified and discussed in Volume II, Appendix A.

### 2.3.1 No-Action Alternative

Implementation of the no-action alternative would mean that the Project would not be constructed and there would be no improvements to the system to address the current electrical system deficiencies. Additionally, the cost savings that would accrue from construction of the Project would continue to be part of the overall cost of producing electricity, and those continuing costs would be reflected in the rates for electricity paid by consumers.

The no-action alternative would preclude construction of system improvements designed to increase the overall Railbelt electrical system reliability and transfer of energy capabilities between the Kenai Peninsula and Anchorage. The following system deficiencies would remain:

- Reliability of the overall Railbelt electrical system and the power supply to consumers on the Kenai Peninsula and in Anchorage would be diminished due to lack of a second path for the power during an interruption of the existing Quartz Creek 115kV line, and the requirement for load shedding in case of system disturbances would continue.

- The electrical transfer capability of the transmission system between the Kenai Peninsula and Anchorage would remain at the current 70 MW and the existing generation resources would continue to be operated in a less than optimum manner. Reductions in operating costs, overall system requirements for spinning reserves, and improved electrical system stability performance would not be realized.

- Access to power entitlements from the Bradley Lake hydroelectric generating station for the utilities north of the Kenai Peninsula would continue to be limited by the electrical system capability. The Bradley Lake generation would remain under-utilized, and the ability of the system to reduce operating costs through increased hydro-thermal coordination and provision of additional spinning reserves to the system north of the Kenai Peninsula would not be realized.

- Transmission line losses and maintenance costs on the Quartz Creek transmission line would remain at the current levels, at a higher cost than if the Project were constructed.

The no-action alternative would preclude the realization of the benefits from construction of the Project. The potential cost savings from the Project would remain as costs embedded in the rates for electricity. Cost savings would be unrealized in the areas of capacity sharing, economy energy transfer, reliability, spinning reserve sharing, reduced line maintenance costs, avoidance of minimum generation on the Kenai Peninsula, and avoidance of the practice of not loading the Quartz Creek transmission line during bad weather and construction.

The no-action alternative does not address the problems that the Project has been proposed to solve.

### 2.3.2 Transmission Line Alternative Routes

#### Enstar Route

The Applicant's proposal is to construct a 138kV transmission line and associated facilities between the Soldotna Substation on the Kenai Peninsula and International Substation in Anchorage (see Figures 2-5 and 2-6). The Applicant's proposed route is the Enstar Route including Route Options E South, F, H, and K. This route begins with an overhead transmission line at the existing substation in Soldotna and replaces an existing 69kV line, running south and then east to the Enstar pipeline (Option E South). At this point the route parallels the Enstar pipeline north through the KNWR along Route Option F to Burnt Island on the east side of Chickaloon Bay (ANILCA application for approximately 38.3 miles on file with USFWS and

USACE). Submarine cables would be used to cross the Turnagain Arm to Oceanview Park on the southern end of Anchorage (Route Option H) and, from the landing point, underground cable would parallel the Alaska Railroad north to 120th Avenue (Route Option K). From there, an overhead line would continue to parallel the Alaska Railroad to the existing International Substation (Route Option K). The overall length of the proposed Enstar Route is 73.4 miles and estimated construction costs would be $90.2 million.

This proposed route includes one alternative in the Soldotna area (E North) that travels north and east from the Soldotna Substation with estimated construction costs at $89.6 million. There are two alternative routing options across Turnagain Arm and in the Anchorage area, as shown on Figures 2-5 and 2-6, including Route Options I and M that follow Old Seward Highway and International Airport Road with construction costs estimated at $90.1 million, and Route Options G and J along Minnesota Drive with estimated construction costs at $90.1 million. These options assume the use of Soldotna South (Option E South).

**Tesoro Route**

The proposed alternative is to construct a 138kV transmission line and associated facilities between the Bernice Lake Substation on the Kenai Peninsula and the Pt. Woronzof Substation in Anchorage. The Tesoro alternative route includes Route Option A - Bernice Lake to Pt. Possession, in combination with any of three options that cross the Turnagain Arm and terminate at the Pt. Woronzof Substation. This route begins as an overhead transmission line at the existing Bernice Lake Substation near Nikiski (Route Option A), and parallels the North Kenai Road to the south end of Captain Cook SRA where the line would transition to underground cable. The underground cable would parallel the North Kenai Road through the Captain Cook SRA. Requirements of the LWCFA, where the Tesoro Route crosses Captain Cook SRA, are met by the underground location for the route. The line would transition back to overhead beyond the north end of the Captain Cook SRA and would parallel the Tesoro pipeline to Pt. Possession. The Tesoro Route crosses two areas of Native conveyed lands within the KNWR. One area is near Grey Cliff Lake (less than 1 mile) and one is at Pt. Possession (approximately 1 mile). The permitting and regulatory requirements of Section 22(g) of ANCSA would apply to the Tesoro Route where Native conveyed lands are crossed. An ANILCA application would be required if lands at Pt. Possession are reacquired by USFWS. At the time that lands were conveyed at Pt. Possession they were under wilderness designation within the KNWR. This portion of the route through the Pt. Possession area would be underground submarine cable extending inland from the landing point to the transition facility.

At Pt. Possession, three options are available to cross the Turnagain Arm and terminate at the Pt. Woronzof Substation. Route Option D would cross the Turnagain Arm from Pt. Possession to Pt. Campbell using submarine cables. From the Pt. Campbell landing, underground cable would continue to parallel the Tesoro pipeline through Kincaid Park and terminate at the Pt. Woronzof Substation (Route Option N). The total overall length of the Tesoro Alternative Route using this option is 62.0 miles, and estimated construction costs are $99.5 million.

Other Tesoro Route options include alternative submarine crossings of the Turnagain Arm. Route Option B crosses Turnagain Arm via Fire Island to the Point Woronzof Substation. The total length of the Tesoro Alternative Route using Option B is 63.2 miles. Estimated construction costs for this alternative are $98.7 million; however, due to very undesirable marine conditions for submarine cables between Pt. Possession and Fire Island, and including high tidal currents and rocky scoured bottom conditions in the Cook Inlet, cable failures would likely be more frequent than for Route Options C or D. Route Option C crosses the Turnagain Arm directly from Pt. Possession to a landing at the Pt. Woronzof Substation with a total length of 61.3 miles. Estimated construction costs for this alternative would be $105.4 million.

## 2.4 ALTERNATIVE ROUTE FACILITIES

As proposed, the following five separate types of facilities will be required for the project: overhead and underground transmission lines, submarine cable, transition stations, and substations. In Table 2-5 each alternative route is identified by segment and by link. Table 2-6 provides a description of the individual links including length, types of facilities that would be used, and existing rights-of-way conditions. Figure 2-8 illustrates typical overhead transmission line structures, while Figure 2-9 illustrates a typical substation. Figure 2-10 illustrates in profile the mix of facilities that would be used to respond to the technical, physical, and environmental constraints imposed by the Kenai Lowlands public and private land use and land management constraints, the Turnagain Arm submarine conditions, and the Anchorage urban setting. Route locations are shown on Figure MV-1 (Volume II), and Submarine Transition Sites are shown on Figures MV-1a and 1b (Volume II).

### 2.4.1 Overhead Transmission Lines

In most areas, the proposed transmission line would be installed overhead. The overhead portion of the transmission line would be operated initially at 138kV, but may be designed with 230kV insulation and conductor spacing in the event that operation of the line at 230kV becomes desirable at some future date.

In order to optimize the cost of construction, operation, and maintenance over the life of the Project, several types of structures were considered for the overhead portion of the transmission line. The four basic structure types that could be used are steel X-towers, wood H-frames, single-shaft steel poles, and single wood poles.

#### Overhead Steel X-Towers

On the Kenai Lowlands, steel X-towers are proposed along the Tesoro Route north of the Captain Cook SRA and on the Enstar Route within the KNWR paralleling the Enstar pipeline. The use of X-towers in these areas where right-of-way width is less constrained allows for fewer structures per mile with longer spans and overall lower construction costs.

**TABLE 2-6**
**OVERVIEW OF ALTERNATIVE ROUTE DESCRIPTIONS**

| Region/ Alternative Route | Route Option Letter Code | Description of Links | Link Number | Miles Crossed | Types of Facility | Existing Conditions | Construction Timing (Season) |
|---|---|---|---|---|---|---|---|
| Kenai Peninsula/ Tesoro Alternative | A | Bernice Lake to Captain Cook SRA - follows North Kenai Road | T1 | 0.2 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: 115kV and 69kV<br>- Adjacent land uses: industrial<br>- Access: paved road | Summer |
| | | | T2 | 0.3 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: roadway<br>- Adjacent land uses - industrial<br>- Access: paved road | Summer |
| | | | T3 | 6.6 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: commercial, residential<br>- Access: paved road | Summer |
| | | | | 0.9 | - Underground cable (two segments)<br>- Rediske and Johnson Airports<br>- Four riser poles | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: commercial, residential, two airstrips<br>- Access: paved road | Summer |
| | | | T4 | 4.7 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: residential<br>- Access: paved road | Summer |
| | | Through Captain Cook SRA - follows park road | T5 | 4.0 | - Underground cable through Captain Cook SRA<br>- Transitions occur at either end of the Park<br>- Two riser poles | - Right-of-way use paralleled: roadway and two pipelines<br>- Adjacent land uses: Captain Cook SRA<br>- Access: paved road and FWD road | Summer |
| | | Captain Cook SRA to Pt. Possession - follows Tesoro pipeline | T6 | 3.6 | - Overhead line segment<br>- Structure type: guyed X steel, heavy | - Right-of-way use paralleled: pipeline<br>- Adjacent land uses: residential<br>- Access: FWD road | Winter/Summer |
| | | | T7 | 22.4 | - Overhead line segment<br>- Structure type: guyed X steel, heavy | - Right-of-way use paralleled: pipeline<br>- Adjacent land uses: residential and Kenai Borough<br>- Access: FWD road | Winter |
| | | | T8 | 0.4 | Underground/submarine cable | - Right-of-way use paralleled: pipeline<br>- Adjacent land uses: private/state lands<br>- Access: FWD trail | Winter/Summer |

**TABLE 2-6**
**OVERVIEW OF ALTERNATIVE ROUTE DESCRIPTIONS**

| Region/ Alternative Route | Route Option Letter Code | Description of Links | Link Number | Miles Crossed | Types of Facility | Existing Conditions | Construction Timing (Season) |
|---|---|---|---|---|---|---|---|
| Kenai Peninsula/ Tesoro Alternative | A | Captain Cook SRA to Pt. Possession - follows Tesoro pipeline | T9 | 1.0 | - Underground/submarine cable | - Right-of-way use paralleled: pipeline<br>- Adjacent land uses: KNWR<br>- Access: FWD overland | Submarine |
| Turnagain Arm and Fire Island/ Tesoro Route | D | Pt. Possession to Pt. Campbell | T17 | 10.1 | - Submarine cable | Turnagain Arm<br>- Right-of-way use paralleled: pipeline<br>- Adjacent land uses: ACWR<br>- Access: water | Submarine |
| | | | T16 | 3.8 | - Submarine cable | Turnagain Arm<br>- Right-of-way use paralleled: pipeline<br>- Access: water | Submarine |
| | B | Fire Island - generally follows road | T11 | 3.1 | - Overhead line segment<br>- Structure type: H-frame wood | - Right-of-way use paralleled: undeveloped<br>- Adjacent land uses: CIRI-VORTAC<br>- Access: water | Summer |
| | | | T12 | 1.4 | - Overhead line segment<br>- Structure type: H-frame wood | - Right-of-way use paralleled: FWD road<br>- Adjacent land uses: CIRI<br>- Access: FWD road | Summer |
| | | | T13 | 0.4 | - Submarine cable | - Right-of-way use paralleled: FWD road<br>- Adjacent land uses: CIRI - airstrip<br>- Access: FWD road | Submarine |
| | | Pt. Possession via Fire Island to Pt. Woronzof | T10 | 9.2 | - Submarine cable | - Turnagain Arm<br>- Access: water | Submarine |
| | | | T14 | 5.0 | - Submarine cable | - Turnagain Arm<br>- Access: water | Submarine |
| | C | Pt. Possession to Pt. Woronzof | T15 | 17.2 | - Submarine cable | - Turnagain Arm<br>- Access: water | Submarine |

**TABLE 2-6**
**OVERVIEW OF ALTERNATIVE ROUTE DESCRIPTIONS**

| Region/ Alternative Route | Route Option Letter Code | Description of Links | Link Number | Miles Crossed | Types of Facility | Existing Conditions | Construction Timing (Season) |
|---|---|---|---|---|---|---|---|
| Anchorage Route Options/ Tesoro | N | Follows Tesoro pipeline and future airport development between Pt. Campbell and Pt. Woronzof | T18 | 4.2 | - Underground cable | - Right-of-way use paralleled: pipeline<br>- Future airport development<br>- Adjacent land uses: airport<br>- Access: existing and trail | Summer |
| Kenai Peninsula/ Enstar Alternative | E-North | Parallels a corridor with multiple transmission lines north from Soldotna Substation | E1 | 1.1 | - Overhead line segment<br>- Structure type: single pole wood, single circuit | - Right-of-way use paralleled: two 115kV and 69kV<br>- Adjacent land uses: residential<br>- Access: gravel road | Summer |
| | | Parallels a 115kV transmission line north of Soldotna | E2 | 0.4 | - Overhead line segment<br>- Structure type: single-shaft steel pole double circuit | - Right-of-way use paralleled: two 115kV<br>- Adjacent land uses: residential<br>- Access: gravel road | Summer |
| | | | E3 | 19.4 | - Overhead line segment<br>- Structure type: H-frame wood | - Right-of-way use paralleled: two 115kV, 69kV, and distribution pipeline<br>- Adjacent land uses: residential, airstrip<br>- Access: undeveloped FWD road, KNWR | Summer |
| | | Parallels Enstar pipeline across KNWR | E4 | 0.7 | - Overhead line segment<br>- Structure type: guyed X steel | - Right-of-way use paralleled: two pipelines<br>- Adjacent land uses: undeveloped<br>- Access: FWD road | Summer |

**TABLE 2-6**
**OVERVIEW OF ALTERNATIVE ROUTE DESCRIPTIONS**

| Region/ Alternative Route | Route Option Letter Code | Description of Links | Link Number | Miles Crossed | Types of Facility | Existing Conditions | Construction Timing (Season) |
|---|---|---|---|---|---|---|---|
| | E-South | Generally parallels a 115kV transmission line northwest of Soldotna | E6 | 1.0 | - Overhead line segment<br>- Structure type: H-frame wood | - Right-of-way use paralleled: 115kV<br>- Adjacent land uses: residential<br>- Access: gravel road | Summer |
| | | | E7 | 0.3 | - Overhead line segment<br>- Structure type: H-frame wood | - Right-of-way use paralleled: none<br>- Adjacent land uses: undeveloped<br>- Access: FWD road | Summer |
| Kenai Peninsula/ Enstar Alternative | E-South | Replacement of 69kV transmission line south of Soldotna | E5 | 17.7 | - Overhead line segment<br>- Structure types: single pole wood (16.1 miles), single circuit, with 12.5kV underbuild (except for Kenai River crossing on H-frame) | - Right-of-way use paralleled: two 115kV, 69kV<br>- Adjacent land uses: residential and Bing's Landing State Recreation Site<br>- Access: gravel road and FWD road | Winter/Summer |
| | F | Parallels Enstar pipeline across KNWR | E8 | 33.1 | - Overhead line segment<br>- Structure type: guyed X steel | - Right-of-way use paralleled: two pipelines<br>- Adjacent land uses: moderate and minimal management<br>- Access: FWD road/trail | Winter |
| | | | E9 | 3.6 | - Overhead line segment<br>- Structure type: single pole wood, single circuit (single wood pole modified for shorter pole heights-spans to reduce clearing and for bird/raptor protection) | - Right-of-way use paralleled: two pipelines<br>- Adjacent land uses: moderate management<br>- Access: FWD trail | Winter |
| | | | E10 | 1.8 | - Overhead line segment<br>- Structure Type: single pole wood, single circuit (single wood pole modified for shorter pole heights-spans to reduce clearing and for bird/raptor protection) | - Right-of-way use paralleled: two pipelines<br>- Adjacent land uses: moderate management<br>- Access: FWD trail | Winter |

**TABLE 2-6**
**OVERVIEW OF ALTERNATIVE ROUTE DESCRIPTIONS**

| Region/ Alternative Route | Route Option Letter Code | Description of Links | Link Number | Miles Crossed | Types of Facility | Existing Conditions | Construction Timing (Season) |
|---|---|---|---|---|---|---|---|
| Turnagain Arm Route Options/ Enstar | G | Submarine - Chickaloon Bay to Klatt Road | E11 | 11.2 | - Submarine cable | - Right-of-way use paralleled: none<br>- Adjacent land uses: ACWR<br>- Access: water | Submarine |
| | H | Submarine - Chickaloon Bay to Oceanview Park | E12 | 10.5 | - Submarine cable | - Right-of-way use paralleled: none<br>- Adjacent land uses: ACWR<br>- Access: water | Submarine |
| | I | Submarine - Chickaloon Bay to Rabbit Creek | E13 | 9.0 | - Submarine cable | - Right-of-way use paralleled: pipeline<br>- Adjacent land uses: ACWR<br>- Access: water | Submarine |
| Anchorage Route Options | J | Klatt Road to International Substation via Minnesota Drive | A5 | 3.3 | - Overhead line segments<br>- Structure type: single-shaft steel pole, single circuit (2.8 miles)<br>- Structure type: single-shaft steel pole, single circuit with 12.5kV underbuild (0.5 mile) | - Right-of-way use paralleled: roadway, 138kV, and three distribution lines<br>- Adjacent land uses: residential, open space, and industrial<br>- Access: gravel road | Summer |
| | | | A4 | 0.3 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: undeveloped<br>- Access: paved road | Summer |
| | | | A3 | 0.5 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: undeveloped<br>- Access: paved road/none | Summer |
| | | | A2 | 0.7 | - Submarine cable | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: Klatt Road<br>- Access: paved road | Submarine |
| | | | A1 | 0.3 | - Submarine cable | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: Victor Road<br>- Access: paved road | Submarine |

**TABLE 2-6**
**OVERVIEW OF ALTERNATIVE ROUTE DESCRIPTIONS**

| Region/ Alternative Route | Route Option Letter Code | Description of Links | Link Number | Miles Crossed | Types of Facility | Existing Conditions | Construction Timing (Season) |
|---|---|---|---|---|---|---|---|
| | K | Oceanview to International Substation via Alaska Railroad | A8 | 1.5 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: railroad<br>- Adjacent land uses: industrial<br>- Access: gravel railroad bed | Summer |
| | | | A9 | 1.8 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: railroad<br>- Adjacent land uses: industrial<br>- Access: gravel railroad bed | Summer |
| | | | A10 | 0.5 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit with 12.5kV underbuild | - Right-of-way use paralleled: railroad<br>- Adjacent land uses: industrial<br>- Access: gravel railroad bed | Summer |
| Anchorage Route Options | K | Oceanview to International Substation via Alaska Railroad | A6 | 0.4 | - Submarine cable as mitigation | - Right-of-way use paralleled: railroad<br>- Adjacent land uses: residential, Flying Crown airstrip<br>- Access: railroad | Submarine |
| | | | | 0.5 | - Underground cable as mitigation | - Right-of-way use paralleled: railroad<br>- Adjacent land uses: residential, Flying Crown airstrip<br>- Access: railroad | Summer |
| | | | A7 | 0.7 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit | - Right-of-way use paralleled: railroad<br>- Adjacent land uses: residential<br>- Access: gravel railroad bed | Summer |
| | M | Rabbit Creek to International Substation via Old Seward Highway | A11 | 0.3 | - Underground segment | - Right-of-way use paralleled: railroad<br>- Adjacent land uses: ACWR<br>- Access: railroad right-of-way | Submarine |
| | | | | 0.7 | - Undergound cable as mitigation | - Right-of-way use paralleled: railroad<br>- Adjacent land uses: shooting range<br>- Access: railroad right-of-way | Summer |
| | | | | 1.9 | - Overhead line segment | - Right-of-way paralleled: roadway<br>- Adjacent land use: residential<br>- Access: paved road | Summer |

**TABLE 2-6**
**OVERVIEW OF ALTERNATIVE ROUTE DESCRIPTIONS**

| Region/ Alternative Route | Route Option Letter Code | Description of Links | Link Number | Miles Crossed | Types of Facility | Existing Conditions | Construction Timing (Season) |
|---|---|---|---|---|---|---|---|
| | | | A13 | 0.7 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit with 34.5kV and 12.5kV underbuild | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: residential<br>- Access: paved road | Summer |
| | | | A14 | 1.5 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit with 34.5kV and 12.5kV underbuild | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: mixed use<br>- Access: paved road | Summer |
| | | | A15 | 1.5 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit with 34.5kV and 12.5kV underbuild | - Right-of-way use paralleled: roadway<br>- Adjacent land uses: mixed use<br>- Access: paved road | Summer |
| Anchorage Route Options | M | Rabbit Creek to International Substation via Old Seward Highway | A16 | 2.3 | - Overhead line segment<br>- Structure type: single-shaft steel pole, single circuit with 12.5kV underbuild | - Right-of-way use paralleled: roadway, 138kV, and two distribution lines<br>- Adjacent land uses: commercial and residential<br>- Access: paved road | Summer |

Notes:
CIRI – Cook Inlet Regional, Inc.
FWD – four-wheel drive
KNWR – Kenai National Wildlife Refuge
VORTAC – VHF Omnidirectional Range Tacan

Construction Timing (Seasons):
Summer = April to October
Winter = November to March
Submarine = May to August (May to June preferred)

This structure has normally been constructed of weathering steel to reduce maintenance costs and provide a nonreflective finish. It carries a single three-phase circuit with the conductors suspended by insulators from a crossarm in a horizontal configuration. At points where the line would angle or dead end, a single-guyed tubular-steel tower for each conductor would be used.

X-towers can be constructed of tubular-steel members or lattice aluminum or steel angles. The X-tower has two legs and two sets of guy wires. The legs would be supported on pile foundations. The foundations usually would consist of one driven or a drilled pile. The anchors may be piles of the same size as the foundations, or they may be screw anchors or grouted anchors. The typical structure is 90 feet tall.

### Overhead Wood H-Frames

On the Kenai Lowlands, wood H-frame structures would be used when paralleling existing H-frame lines north of Soldotna Substation to match existing line construction and for rebuilding existing lines. H-frames are constructed of two vertical wood poles with two horizontal wood crossarms and braces. The poles are normally placed in augured holes with either native or imported backfill. The typical structure is 90 feet tall.

### Overhead Single-Shaft Steel Poles

On the Kenai Lowlands and in the Anchorage area, single-shaft steel pole structure types would be used along North Kenai Road north of Bernice Lake Substation and in south Anchorage, where right-of-way width is constrained and shorter span length is more appropriate.

This type of structure is normally constructed of weathering, galvanized, or corten steel and is used in areas of restricted right-of-way and within existing road rights-of-way. This type of structure can be designed to carry either a single three-phase transmission circuit or with lower voltage circuits attached beneath the transmission circuit (underbuild). The conductors would be supported by either post or suspension insulators.

Single-shaft steel poles are normally designed specifically for each line location. Mechanical loads and required clearances dictate pole heights and diameters. Typical structure heights would be approximately 75 feet. Foundations for single steel poles are dependent on the soil type and could be either a concrete pier or piling, or the pole could be directly embedded in the soil. Steel poles are self-supporting structures and would not require guys and anchors except at angle or terminal structures.

H-Frame

Single-Pole

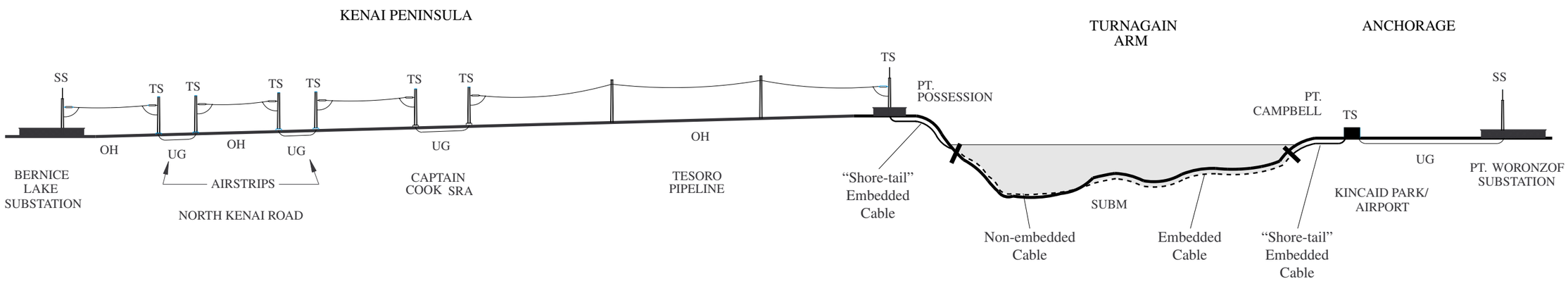
X-Frame

# TYPICAL OVERHEAD LINE STRUCTURES

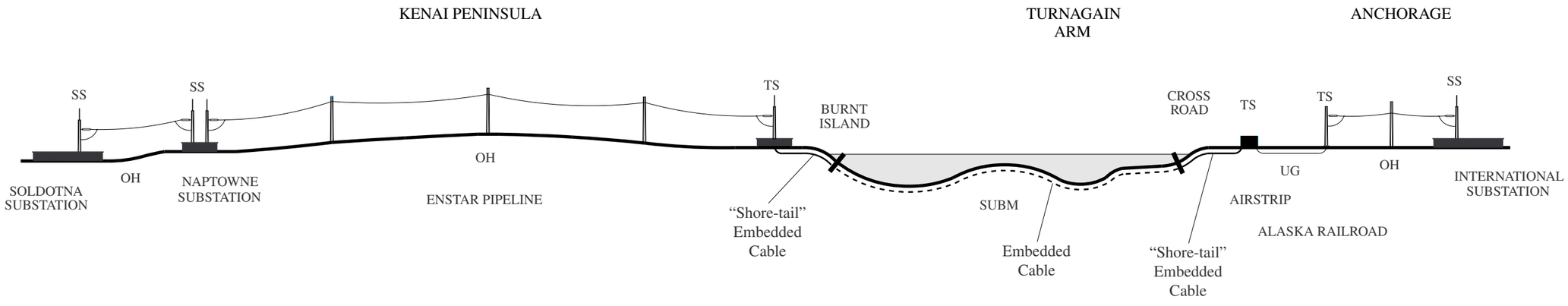
**SOUTHERN INTERTIE PROJECT**
**FIGURE 2-8**

**TYPICAL SUBSTATION**
**SOUTHERN INTERTIE PROJECT**
**FIGURE 2-9**

TESORO ROUTE




ENSTAR ROUTE




**LEGEND-FACILITY TYPES**

OH - OVERHEAD LINE
UG - UNDERGROUND LINE
SUBM - SUBMARINE CABLE
TS - TRANSITION STATION
SS - SUBSTATION

**NOT TO SCALE**

**REPRESENTATIVE ROUTE PROFILES**
**SOUTHERN INTERTIE PROJECT**
**FIGURE 2-10**

### Overhead Single Wood Pole

On the Kenai Lowlands, single wood poles are proposed to be used north of the Soldotna Substation to match the existing wood pole transmission lines south of Bing's Landing and near Chickaloon Bay on the Enstar Route.

The single wood pole is appropriate in areas of minimum right-of-way and shorter spans. This type of structure blends with the environment and has a history of long service life. This type of structure can be designed to accommodate both transmission level and lower voltage distribution circuits on the same pole. Either post insulators or suspension insulators attached to crossarms can support the conductors. Angles and dead ends would be guyed. Single wood poles are normally directly embedded in the native soils. Mechanical loads and clearances determine the height and pole class required for each location. Typical structure heights would be 70 feet.

In the area near Chickaloon Bay, short span lengths would be employed to minimize structure heights to approximately the height of the surrounding taller trees. Structure heights have been limited to mitigate concerns with right-of-way clearing and with bird collisions and raptor considerations.

### Overhead Conductor and Ground Wire

An aluminum conductor steel reinforced 1.1-inch-diameter "Drake" conductor is proposed for the Project. The outside surface would weather with time and tend to become nonreflective. A fiber optic overhead ground wire (OPGW) is being considered to provide a communications path for system protection functions, as an alternative to a microwave communications system. If installed, the OPGW would be located in the shield wire position above the conductors for the X-Frame and H-Frame structures, and either below or above the conductors for the single pole structures, depending on structure type and configuration (see typical structure drawings in Volume II, Appendix B). A typical OPGW is composed of optical fibers contained within a steel reinforced cable of approximately 5/8-inch diameter.

## 2.4.2 Underground Transmission Lines

In certain areas, the proposed transmission line would be installed underground, for relatively short distances, as mitigation to avoid potential impacts in sensitive areas (e.g., airspace and areas stipulated for underground utilities).

Placing a 138kV transmission line underground is more expensive and complex than constructing the same line overhead. An underground transmission line requires a continuous trench along the entire length of the facility, which is similar to the installation of a buried pipeline. In addition, cable-splicing vaults are required approximately every 2,000 feet.

An underground transmission line must be insulated along its entire length since it is buried and in contact with the ground. The insulation for the underground transmission conductors must be

specially designed to withstand the high voltage on the conductors contained within the cable. The high-voltage cable insulation also must be designed to dissipate the heat resulting from the flow of electricity through the conductors. For heat dissipation, the backfill materials used to fill the trench also must be designed to effectively draw the heat away from the cables and keep them cool, prolonging cable life.

### 2.4.3 Submarine Cable

Turnagain Arm, between the Kenai Peninsula and Anchorage, would be crossed using a transmission cable specially designed for the marine environment. Submarine cable is designed to accommodate a wide range of marine floor conditions and varying seabed materials. Each alternative route crossing the Turnagain Arm involves a wide range of unique conditions resulting from significant tidal flow, marine bed material movement, strong currents, and ice scour. Cables will be armored, and embedded where feasible, to minimize or prevent damage to the cable from natural hazards in submarine and terrestrial environments.

#### Submarine Cable Systems

Submarine cables can be manufactured in various configurations depending on the voltage level and conductor size required for the application. For the security and reliability of power supply, a three-core cable system requires a second cable to be installed. A single-core cable system typically requires four cables for a three-phase circuit scheme, with the fourth cable being an on-line spare in the event of one of the operating phases being damaged.

### 2.4.4 Transition Stations

Since three different types of transmission facilities are proposed for this Project (overhead, underground, and submarine), a series of transition stations would be necessary to convert the transmission line from one form to another. The following configurations are considered.

#### Underground to Overhead Transitions

For the transition from underground to overhead lines the first method is the use of a single riser pole termination structure that is fitted with arms to support underground cable terminations. The riser pole configuration design is based on a single shaft steel pole, typically sited along a roadway as one of the structures in a steel pole transmission line. The second method, used in areas where land is available for a fenced enclosure, is construction of a transition station that uses a single three-phase termination take off tower structure, H-frame, for the terminal components of both the underground and overhead lines.

### Underground to Submarine Transitions

The first method of transitioning from underground cable to submarine cable is where the underground and submarine cable circuits enter a transition station and are terminated on an outdoor structure. A second option would have the submarine cables entering and terminating in an SF6 gas insulated substation. While more costly, gas insulated substations are used when the land available is insufficient to fit a normal air insulated substation on the parcel of land. Table 2-7 and Figure MV-1a (Volume II) identify transition site locations and the type of transition for each region of the Project.

### Submarine Cable Transition Stations

Submarine cable transition sites would be located, typically, approximately 800 to 1,000 feet on shore where the submarine cable makes landfall for a transition to either an overhead or underground transmission line. The submarine cable transition sites vary in configuration, but all contain either outdoor or gas insulated structure terminations and their corresponding enclosures or structures. Both termination systems at each end of the submarine cable segment require dielectric fluid-feeding systems for the submarine cables and an automated control and monitoring unit. This includes pressurization equipment used for the self-contained fluid filled (SCFF) submarine cables. The dielectric fluid system is completely enclosed so no fumes or fluid would normally escape the supply system. In the unlikely event of a fluid leak, a fluid containment system, having sufficient capacity to retain the total volume of supply fluid at the site, would contain the leak.

## 2.4.5 Substations

A number of factors are considered in the design of a substation. These factors include cost, available space, transmission line access, future expansion, operational requirements, maintenance, and reliability.

Since reliability is a primary concern for the proposed intertie, two main types of substation arrangements have been selected—ring bus and breaker and a half. These two arrangements strike a reasonable balance between reliability and construction cost. The ring bus is applicable where the number of terminals would not exceed a maximum of four and would be used for additions to the Bernice Lake and Pt. Woronzof substations, and for the new Naptowne Substation. The breaker and a half would be used for applications where more than four terminals are expected and would be used for additions to the Soldotna and International substations. Typical equipment to be installed at substation sites includes high-voltage circuit breakers, transformers, reactors (which have a similar visual appearance as transformers), steel structures to support electrical bus work and switches, control building, and a tower to support communication antennas. Table 2-8 identifies the proposed substation arrangements and corresponding layout drawings for this Project.

### Reactive Compensation Sites

Reactive compensation involves installation of specialized equipment in a substation to provide voltage support for the system or to increase power flow across a transmission line segment. Reactive compensation is proposed for additions to the International, Pt. Woronzof, and the new Naptowne substations. The transition site at the Pt. Possession south site also would incorporate reactive compensation.

### Substation Modifications

Two existing substations that are integral parts of the electric power system in the nearby geographic area are the Dave's Creek and the Bradley Lake substations. Dave's Creek Substation is located in the Chugach Mountains on the Kenai Peninsula. Electrical reinforcement of the existing line at the Dave's Creek Substation would consist of adding additional reactive compensation equipment to the existing substation.

The Bradley Lake Substation is located at the Bradley Lake Hydroelectric Plant on the south end of the Kenai Peninsula. Equipment will be added to the existing state of Alaska-owned microwave sites between Soldotna and Bradley Lake. Equipment to be added at the existing substation would consist of microwave transmit and receive gear along with tone gear to signal and detect transfer trip signals from the remote stations. The equipment would be installed within the existing control buildings at the substation and at the microwave sites between Bradley Lake and Soldotna, and are essentially an equipment replacement to the existing microwave system.

## 2.4.6 Communications for Relaying and Control

Communications for relaying and control for the Project would utilize the existing microwave system. It is anticipated that any additional equipment required would be housed within the existing control building at the substation. For any new substations, such as the Naptowne Substation, communications equipment would be contained within the control building at the site, except for the microwave antenna, which would be mounted on a mast outside the control building within the substation fenced area, the same as at existing substations.

An alternative to using the existing microwave system would be to use the fiber optic cable being considered for installation on the transmission line. The required equipment would be housed within the control building at the substation. One advantage to the fiber optic cable is the band width available for communications over the fiber. In addition to providing communication and control for the Project, the fiber optic cable could also be designed to have the capacity for other uses, such as for telecommunications.

| Transition Sites | Cable Transition Type and Drawing Reference | | | | | Transition Site Type | Footprint Size | Enclosure | Link Numbers | Secondary Power Requirement |
|---|---|---|---|---|---|---|---|---|---|---|
| | Reactor Required | Submarine Cable Terminal Required | Overhead/ Solid Dielectric | Submarine/ Overhead | Submarine/ Solid Dielectric | | | | | |
| **Tesoro Corridor** | | | | | | | | | | |
| **Kenai Lowlands** | | | | | | | | | | |
| Rediske Airport-1 | | | TS-05 | | | Riser pole | 3.1 meters (10 feet) diameter | None | T3 | None |
| Rediske Airport-2 | | | TS-05 | | | Riser pole | 3.1 meters (10 feet) diameter | None | T3 | None |
| Johnson Airport-1 | | | TS-05 | | | Riser pole | 3.1 meters (10 feet) diameter | None | T3 | None |
| Johnson Airport-2 | | | TS-05 | | | Riser pole | 3.1 meters (10 feet) diameter | None | T3 | None |
| South End Captain Cook SRA | | | TS-05 | | | Riser pole | 3.1 meters (10 feet) diameter | None | T5 | None |
| North End Captain Cook SRA | | | TS-05 | | | Riser pole | 3.1 meters (10 feet) diameter | None | T5 | None |
| Pt. Possession South | x/RC-01 | | | TS-03 | | Outdoor substation | 61.0 x 30.5 meters (200 x 100 feet) | Fence | T8 | Yes |
| **Turnagain Arm** | | | | | | | | | | |
| Fire Island South | | x | | TS-03 | | Outdoor substation | 39.6 x 30.5 meters (130 x 100 feet) | Fence | T11 | Yes |
| Fire Island North | | x | | TS-03 | | Outdoor substation | 39.6 x 30.5 meters (130 x 100 feet) | Fence | T13 | Yes |
| **Anchorage Bowl** | | | | | | | | | | |
| Pt. Woronzof submarine | x | x | | SS-17 | | Outdoor substation | Existing | Fence | T14 and T15 | Yes |
| Pt. Campbell | | x | | | TS-04 | Outdoor substation | 39.6 x 30.5 meters (130 x 100 feet) | Fence | T18 | Yes |
| Pt. Woronzof via Pt. Campbell | x | | SS-17 | | | Outdoor substation | Existing | Fence | T18 | Yes |
| Klatt Road | | x | | TS-03 | | Outdoor substation | 39.6 x 30.5 meters (130 x 100 feet) | Fence | A2 | Yes |
| **Enstar Corridor** | | | | | | | | | | |
| **Kenai Lowlands** | | | | | | | | | | |
| Burnt Island | | x | | TS-03 | | Outdoor substation | 39.6 x 30.5 meters (130 x 100 feet) | Fence | E10 | Yes |
| **Anchorage Bowl** | | | | | | | | | | |
| Cross Road North | | x | | | TS-07 | Gas insulated substation | 9.1 x 9.1 x 7.6-high meters (30 x 30 x 25-high feet) | Small building | A6 | Yes |
| 120th Avenue | | | TS-05 | | | Riser pole | 3.1 meters (10 feet) diameter | None | A6 | None |
| Klatt Road | | x | | TS-03 | | Outdoor substation | 39.6 x 30.5 meters (130 x 100 feet) | Fence | A2 | Yes |
| Shooting Range | | x | | | TS-07 | Gas insulated substation | 9.1 x 9.1 x 7.6-high meters (30 x 30 x 25-high feet) | Small building | A11 | Yes |
| Old Seward Highway | | | TS-05 | | | Riser pole | 3.1 meters (10 feet) diameter | None | A11 | None |

Riser pole – Single-shaft steel pole cable riser structure
Station – Crushed rock surface with fence control
Outdoor substation – Crushed rock surface with fence control of access and small control building
GIS – Gas insulated switchgear contained within a building

Drawings referenced are in Volume II
TSO – Transition Station
A – Air insulated
P – Pole structure
H – H-frame structure
G – Gas insulated substation

**TABLE 2-7**
**TRANSITION SITES – SUMMARY**
**OF LOCATIONS AND FEATURES**

**TABLE 2-8**
**SUBSTATION SITES – SUMMARY OF LOCATIONS AND FEATURES**

| Substation Site | New Reactive Compensation | Substation Drawing Reference | Footprint Size | Link Numbers | Comments |
|---|---|---|---|---|---|
| **KENAI LOWLANDS** | | | | | |
| Bernice Lake | - | SS-09 | 190 x 220 feet, addition | T1/south end | Ring bus addition to the substation |
| Soldotna | - | SS-15 | 150 x 120 feet, addition | E1/south end | Breaker and a half operating as a ring bus |
| Naptowne (new) | Reactor | NAP-01 | 150 x 200 feet, new | E5/E6 | Ring bus |
| Bradley Lake and associated stations | - | Protection and control equip-ment additions (no drawings) | N/A | Existing site; located out of study area at the south end of the Kenai Peninsula at Bradley Lake | New transfer trip system protection |
| **CHUGACH MOUNTAINS** | | | | | |
| Dave's Creek | SVS or TCSC | RC-08 | 150 x 200 feet, addition | Existing site; located out of the study area south of the junction of the Sterling and Seward highways | Power system reliability and stability corrections |
| **ANCHORAGE BOWL** | | | | | |
| International | Reactor | SS-11 | 150 x 60 feet, existing | A16/west end | Breaker and a half bay addition |
| Pt. Woronzof | Reactor | SS-17 | 300 x 200 feet, addition | T18/north end | Ring bus addition |

TCSC = Thyristor-controlled series capacitors
SVS = Static var system
Drawings referenced in Volume II, Appendix B

## 2.5 CONSTRUCTION SPECIFICATIONS

### 2.5.1 Construction Seasons

**Overhead Facilities**

Construction would take place during both summer and winter seasons. The cost of construction and sometimes the quality of construction can be affected by the construction season. During the winter season temperatures are very cold, which affects the equipment operation; the amount of daylight is minimal; fewer workers are available; and the work force efficiency is significantly reduced. During the summer season, temperatures are warmer, sunlight is almost continual, and more workers are available.

While construction during the summer season may be preferred, there are issues that may require winter construction. Project schedule, financing, design, and/or material delivery cannot always fit within the short summer season. Environmental issues may dictate construction of certain portions of the line during winter. Soft, wet soils often cannot support heavy construction equipment and construction activities in areas of such soils could result in long-term damage. Within the KNWR, restrictions likely would be required during sensitive periods for certain wildlife species. Winter construction is proposed for the Tesoro Route north of Captain Cook SRA, the Enstar Route within the KNWR, and along selected portions of the Soldotna E South Route option near lowlands along the Kenai River. If abnormal winter conditions are encountered, construction timing can be altered or winter conditions could be recreated.

**Underground Facilities**

In the Kenai Lowlands, the underground transmission line construction along north Kenai Road and in the Captain Cook SRA would take place during the summer season as would underground construction in the Anchorage area. For other areas where underground construction may be required, the season and specific requirements would be determined as the plan of development is prepared and in conjunction with obtaining permits.

**Submarine Cables**

Installation of the submarine cables must occur when the Turnagain Arm is free of ice and ideally when wind speeds are lowest. The months of May through August are suitable, with May and June being preferred.

**Transition Stations and Substations**

The transition station equipment could be installed during the summer season. Construction for substations and reactive compensation sites could be completed during one summer season, if multiple crews were utilized or could be scheduled over two summer seasons.

### 2.5.2 Right-of-Way Acquisition Process

In addition to Project authorizations and permits granted by state and federal natural resource management agencies, easement and permit rights must be acquired from a variety of private entities and other state agencies. Permits may be required from respective municipalities and boroughs, as well as from the ADOT and the Alaska Railroad Corporation. Where the Project crosses other utility rights-of-way, such as pipelines or other utility lines, crossing or encroachment permits would be required. In general, these permits would be approved, as long as the utility adheres to commonly accepted design criteria and construction methods. In some cases, such as with the railroad and pipeline companies, the permits are conditional upon the installation of devices designed to mitigate the potential for electrical interference with communication systems or to provide cathodic protection of pipeline systems.

Easement acquisition would be required to secure utility transmission line rights across private properties. This process would proceed according to utility right-of-way acquisition policies and procedures.

Right-of-way acquisition would first require a validation of the property's fee interest owner(s). A centerline survey would be conducted and easement descriptions written. The land value would be verified to determine the easement offer to be made to the landowner. A right-of-way agent would personally contact all resident landowners. Absentee landowners would be contacted by telephone and certified mail.

During construction, inspectors would monitor activities to ensure that any negotiated mitigation measures and other landowner concerns are honored by the construction contractor. Any project-related damage to private property would result in repair and/or compensation to the landowner.

In rural areas where the Project parallels existing transmission lines, a 100-foot right-of-way immediately adjacent to the existing line would be obtained. In rural areas where the Project would be the only transmission line, a 150-foot right-of-way would be obtained, for example, adjacent to the Tesoro and Enstar pipelines. For the portions of the Project that would be underground, but not parallel to existing roadways, a 50-foot-wide construction easement and a 30-foot-wide permanent easement would be obtained. For underground lines paralleling roadways, a 30-foot-wide easement immediately adjacent to the paved area of the roadway would be obtained.

For the overhead portions of the Project paralleling public roadways, the single-shaft steel poles would be located at the edge of the right-of-way, either within the road right-of-way or on

private land. A 30-foot-wide easement on private land adjacent to the line along the road right-of-way would be obtained. Along some links, existing buildings are very close to or encroach on the existing road right-of-way. In these areas purchase or relocation of the buildings may be necessary. Alternatively, in these situations the poles could be located within the road right-of-way and an overhang easement could be obtained for the conductors overhanging private property. Otherwise, the conductor could be installed with horizontal post insulators, all on the roadside, thus negating the need for any easement on private property. Each of these situations would be addressed individually during the detailed design and right-of-way acquisition process.

### 2.5.3 Construction Access

#### Overhead Facilities

Access to the right-of-way generally will be along existing roadways or trails. Links in which new access would be required include Link E7 north of Naptowne and Link T11 on Fire Island. In south Anchorage new access would be required for Link A3 north of the radio station, and along Minnesota Drive Link A5. ADOT has specified that the paved roadway cannot be used for access for construction; rather, access for construction must be outside the highway right-of-way or along the edge of the highway right-of-way.

All other links have existing access. Travel between structures would be overland along the right-of-way or via existing roadways or trails.

For the portions of the Project where overhead lines would be constructed, typical equipment types for the various access conditions have been divided into four categories as listed in Table 2-9. Construction methods and operation and maintenance activities require similar types of equipment.

**TABLE 2-9**
**TYPICAL CONSTRUCTION EQUIPMENT AND ACCESS CONDITIONS**

| Access Conditions | Access Type | Typical Construction Equipment |
|---|---|---|
| Existing roadways | 1 | Rubber-tired vehicles |
| Existing trails summer or winter | 2 | NODWELL, bulldozer |
| Soft soils, difficult trails, bogs, stream crossings, winter conditions | 3 | Specialized equipment; low ground pressure vehicles, tracked vehicles, swamp mats or temporary bridges, snow machine, snow cat |
| Stipulated access or winter conditions | 4 | Helicopter construction with ground access |

#### Underground Facilities

Existing roads, bridges, field roads, and trails would be used for access to the right-of-way. Where this is not possible, equipment would be required to move over land with minimal impact. Soft soils may require additional support such as mats or temporary bridges. In some cases, a temporary culvert may be installed where a stream is crossed. Construction trails would be

graded and revegetated in accordance with the approved mitigation plan. Existing roads and trails would be maintained and repaired as required during use by the construction contractor.

Clearing would be performed as required to allow for access and construction of the underground line and to maintain access for operation and maintenance of the underground system. Gates would be installed, as required, in existing fences located on the right-of-way to facilitate construction access.

Survey work on the right-of-way may involve limited trimming of trees and vegetation for line-of-sight staking and distance measuring. No new roads would be established during surveying, since only survey crews and their equipment would be involved. Typical equipment types for the various access conditions have been divided into four categories as listed in Table 2-10.

**TABLE 2-10**
**UNDERGROUND CONSTRUCTION**

| Construction Types | Access | Construction Equipment |
|---|---|---|
| 1 | Existing roadways | Rubber-tired vehicles |
| 1, 2 | Existing trails | NODWELL |
| 3 | Soft, difficult trails | Special sized equipment, low bearing pressure |
| 1, 5 | Stream crossing | Rubber-tired vehicles, special equipment-bridge |

### Submarine Cables

Access to the submarine cable right-of-way would be primarily by watercraft (e.g., boat or work barge). Excavation equipment could access the shore-tail landing areas by land where there are roads or trails leading to the work area. For the shore-tail landing areas without road or trail access, the installation equipment would be transported to the work sites by barges. Most installation equipment for the laying of the cable would be moved to the work sites by barges or boats.

### Transition Stations

Beyond the site clearing to install the transition station, a permanent site access would be required. The access requirements would vary with the location and type of transition station. A transition station requires access for construction, cable pulling and termination activities, and operation and maintenance access for inspection and the collection of data. This access would be provided on the same roads used to access the high-voltage equipment installed at the sites. A helicopter would be used for routine visits to remote locations for periodic inspections or for repairs not involving heavy equipment. Pt. Possession is the only proposed remote transition site with a heavy reactor. While access via land is available along the Tesoro pipeline road, for initial installation, or in the event of a failure, transport of the reactor would likely be by barge.

### Substations

Substations require permanent access roads. Care in construction would usually eliminate concerns about construction on soft soils. It is anticipated that most equipment, with the exception of some earthmoving equipment, would be conventional rubber-tired equipment since permanent access roads are anticipated.

Equipment for operation and maintenance would generally be limited to four-wheel drive vehicles and snowmobiles or tracked vehicles, depending on the season. Occasionally, a small truck mounted crane would be used to repair failed equipment.

## 2.5.4 Construction Activities

### Overhead Transmission Line

Typical activities during the construction of an overhead transmission line include soil boring, surveying, clearing, foundation installation, structure assembly and erection, conductor installation, and cleanup. A detailed description of these activities is included in Volume II, Appendix B. These tasks generally occur in sequence and may be separated in time by several days to several months. Although construction activities would be similar in both the Kenai Lowlands and the Anchorage area regions, situations in either region may vary and require site-specific consideration. All of these activities would be coordinated, according to the permit stipulations, between the IPG's construction manager, the construction contractor, and the agency having jurisdiction in a particular area.

### Underground Facilities

Construction time for the Kenai Lowlands and Anchorage area underground portion of this Project would vary depending on the route selected. The construction of the underground portion of this Project can be divided into construction phases to shorten construction time and maximize the use of local contractors on a phase-to-phase basis, if desired. The underground construction of a circuit mile is typically more time- and cost-demanding than a mile of an equivalent overhead construction line. Specific construction activities would take place prior to and during the underground cable installation. The activities include the following:

- soil borings and thermal resistivity testing of the soil
- surveying
- clearing
- site preparation
- duct bank system installation
- cable installation
- cable testing
- termination and splicing of underground cables

These activities occur in a specific order and are described in Volume II, Appendix B along with the materials and equipment required.

### Submarine Cable

Although the submarine cables for this Project are specially designed to accommodate a wide range of marine floor conditions, the installation of each submarine cable is an important part of the cable system operating life span. Submarine cable installation would include various construction techniques to accommodate different conditions along each specific shore/marine route. The three conditions of installation involve (1) shore-tail installation, (2) tidal mud flats, and (3) deep channel crossings.

The submarine cable installation techniques proposed would be designed to address each of the three conditions and selected appropriately for the specific location.

There are a number of installation techniques available for each of the three conditions identified above. All the appropriate installation techniques determined to be applicable to this Project are presented in Volume II, Appendix B. Final selection of each installation technique would depend on final pre-installation surveys, equipment availability, and contractor preference.

### Substation

Substation construction activities would include soil boring, surveying, clearing and grading, grounding, fencing, foundation installation, structure and equipment erection, control building erection, conductor installation, conduit and control cable installation, and cleanup. These activities are described in Volume II, Appendix B. The sequence and timing of these tasks are determined by specific conditions at the site and contractor preference.

## 2.5.5 Operation, Maintenance, and Abandonment

System dispatchers in power control centers would direct the day-to-day operation of the connected overhead, underground, and submarine segments of the transmission line. These dispatchers use supervisory equipment to operate circuit breakers at each end of the line. The circuit breakers also operate automatically to further ensure safe operation of the transmission line and isolate the line from the rest of the system during a disturbance.

Emergency maintenance would involve prompt movement of crews to repair damage or replace equipment.

### Overhead Facilities

Typical preventive maintenance programs for transmission lines would include routine aerial and ground inspections. Aerial inspections also would be conducted after a system disturbance causes a circuit breaker to operate.

Ground inspections would be conducted usually to detect equipment needing repair or replacement. Whenever possible, ground inspections and subsequent repair activities would be scheduled during the summer months. Trees that have grown to endanger operation of the line are normally removed during the summer.

When the facility is no longer needed, the transmission line structures, conductors, insulators, and hardware would be dismantled and removed from the right-of-way.

### Underground Facilities

Maintenance requirements on the underground cable include periodic visual inspection of cable terminators, link boxes, and splices and integrity testing of cable jacket.

When the facilities are no longer needed, the underground cable would be abandoned in place. The transition poles and stations, terminations, arresters, and hardware could be dismantled and removed from the right-of-way. Cable vaults could be filled with sand or sealed, and the surface area restored to pre-project conditions.

### Submarine Cables

Maintenance of the submarine cable transmission line would involve a periodic marine survey to inspect the condition of the marine floor along the cable route and evaluate the possibility of any external mechanical damage.

The frequency of the surveys would be once every five years. This would be accomplished with a small boat and hydrographic survey equipment. Cathodic protection testing equipment would be temporarily located at the terminal ends of the submarine cable approximately once every two years to determine the integrity of the submarine cable armor wire.

Since 1967, CEA has been installing, operating, and replacing submarine cables in the Knik Arm and has experience with catastrophic and non-catastrophic outages of their submarine cables. During the summer of 1999, four new cables, similar to those proposed for the Southern Intertie Project, were installed from Pt. Woronzof to Pt. McKenzie to replace existing failed cables that are now inactive.

Submarine cables are filled with biodegradable alkylbenzene oil. The fluid in cables that currently cross Knik Arm is a synthetic extra fluid alkynate, a benzene derivative with a C-10

hydrocarbon chain. Leak rates of previously damaged cables in Knik Arm have been between 2.5 and 9 gallons per day. There, it was estimated that with a leak rate of 2.5 gallons per day, the concentration of the fluid in the initial mixing zone would be 0.25 parts per billion. Toxic effects were not reported. Were a cable to be damaged in the Turnagain Arm, the situation would also likely cause no toxic effects. Because of the large dimension of the receiving water, and a large degree of mixing achieved by tidal turbulence, the water has a very large assimilative capacity and so the effective concentration of the fluid in the water would be negligible. No hazardous constituents have been identified in the insulating fluid.

Further, toxicity to marine organisms has not been found in either laboratory tests or in actual occasions of leaks of the insulating fluid. Two studies by Italian laboratories to assess the toxicity of the fluid to marine and freshwater organisms provided evidence of low toxicity at concentrations greater than would be expected in the event of an actual leak. Several discharges of cable fluid have occurred around the world, including an incident in Connecticut, and no reports of toxic effects have occurred (CEA 1989, 1990).

Based on CEA experience with the Knik Arm cables, catastrophic failure of a submarine cable results in an initial fluid loss of about 16 gallon/hour due to the operating pressure. Within 1 to 2 hours of the failure, the fluid pressure is reduced and the fluid loss drops to less than 1 galllon/hour. This flow would be maintained to prevent seawater penetration into the cable until it is determined whether the cable is to be repaired or deactivated. If a cable is determined to be unrepairable, then the fluid supply is cut off. Once the fluid supply has been cut off, fluid will continue to flow out of the damaged end of the cable until equilibrium is established between the fluid pressure in the cable and surrounding water. An additional 4 to 8 gallons of fluid are lost during this equalization process. Once stabilized, no additional fluid escapes from the cable unless further damage is sustained.

A non-catastrophic cable failure is usually first noticed by a loss of fluid pressure. If a spare cable is available, the damaged cable will be taken out of service and the rate of fluid loss determined. The fluid pressure in the damaged cable is then reduced to a level to prevent penetration of seawater. Depending on the severity of the damage, a determination to repair or deactivate the cable is made. If repair is determined to be feasible, the cable will be maintained with a fluid pressure sufficient to prevent the intrusion of seawater, and the attendant fluid loss (usually about 1 to 2 gallons per day) would continue until repairs can be completed.

When a failure has occurred in the past, CEA has notified the Alaska Department of Environmental Conservation (ADEC) and would do so if cable damage and fluid loss is detected for the proposed Project submarine cables.

The outage performance of CEA's existing submarine cables has been analyzed and the projected outage rates for the proposed submarine cables crossing the Turnagain Arm are summarized in Chapter 1. For example, with two three-phase cables directly embedded in the sea floor along the Enstar Route, and based on the performance history of the existing cables, 0.6 unscheduled outages are projected during the 40-year project life.

A decision to repair a submarine cable involves an assessment of the performance history of the cable and the degree and location of the cable damage. The constant movement of silt and other material in the Turnagain Arm due to tidal action may make recovery of the submarine cable for repair difficult or infeasible, as the amount of material deposited in a given area may vary from year to year. The effective burial depth of the cable due to tidal action may be so deep as to effectively prevent exposure of the cable for repair.

In the event a submarine cable is unrepairable, a complete new cable would be installed using the same procedures used for original installation.

**Transition Stations**

Operation and maintenance of the transition station site would require structure inspection and, at sites involving submarine cable, the monitoring of the dielectric fluid pressure gauge and alarm system. This would include a visual inspection of the dielectric fluid feeding system, all sites would include inspection including cable terminations and sheath bonding and grounding system. Remote monitoring devices are planned to be installed to assist in operation and maintenance of the facility. Sites would be visited every two to three months. For those sites with reactors and circuit breakers, inspections would take place monthly. Equipment testing and operation checkout would be performed approximately every five years.

When the facility is no longer needed, all equipment, building materials, etc. will be removed from the site and the site restored in accordance with the site mitigation and restoration plan.

Transition stations involving submarine cable would include additional removal operations. Before abandonment or removal, the dielectric fluid in the submarine cable and accessories including the fluid feeding system would be purged with nitrogen and removed from the site and disposed of in compliance with all relative environmental regulations. The terminal station site would be cleared of all equipment, construction facilities, and materials and the site restored in accordance with the mitigation plan.

**Substations**

System dispatchers in power control centers would direct the day-to-day operation of the substations and reactive compensation sites. These dispatchers use supervisory equipment to operate and monitor the equipment in the substations to configure the system and direct power flow. The protective relays in the substations detect faults on the substations and transmission lines and automatically open circuit breakers to isolate faulted equipment.

Typical maintenance programs for substations and reactive compensation sites include routine visual inspections of equipment and periodic testing of equipment. The frequency at which equipment is tested and maintained depends on utility practice and operating conditions. Each

utility has its own program of regular testing and calibration to ensure that the substation equipment is performing correctly.

When the facility is no longer needed, the substation structures and equipment would be dismantled and removed from the site. The site would be restored to its original condition.

## 2.6 ALTERNATIVE ROUTE COMPARISON

### 2.6.1 Alternatives Comparison Process and Results

Table 2-11 (page 2-62) provides a detailed comparative analysis of the resources and resource impacts for each route option. (Refer to Table S-2 for a generalized summary comparison of alternatives.) Table 2-11 is organized by geographic region, with the route options beginning in the south and progressing northward. Along the left-hand side of the pages are found the route options, in letter sequence, with the links that make up that route, the route's path and whether it is along the Tesoro or Enstar route, and that option's length. The descriptions of the route options provided assume a southern starting point. In addition to the primary route alternatives presented in Table 2-11 and illustrated on Figures 2-5 and 2-6, several other route combinations in the Anchorage area were considered in this EIS and are presented in Volume II, Appendix A. These routes have been studied extensively in the past; however, they are not part of the Applicant's proposed alternative or the environmentally preferred alternative.

For each resource within a route option, the table provides an identification of key elements associated with the inventory, impacts, and mitigation. A determination of significant impacts remaining after mitigation and cumulative effects (if present) are also identified. The basis for the information provided for each resource in Table 2-11 is contained in Chapter 3.

A numerical ranking by preference is provided at the bottom of each cell in the table. This "preference" ranks the route options for that resource only, and compares only that group of route options. If more than one route option has the same preference number, it indicates that those routes are tied for that resource comparison. An environmentally preferred alternative has been identified as a result of this comparison and is noted in Table 2-11 and presented in Section 2.6.2. A description of the Applicant's proposed alternative and the rationale for its selection is presented in Section 2.6.3.

### 2.6.2 Environmentally Preferred Alternative

Section 1505.2 (b) requires that, in cases where an EIS has been prepared, the Record of Decision must identify all alternatives that were considered, "…specifying the alternative or alternatives which were considered to be environmentally preferable." The CEQ recognizes that the identification of the environmentally preferable alternative may involve difficult judgments, particularly when one environmental value must be balanced against another. CEQ encourages

agencies to make recommendations of the environmentally preferable alternative(s) during EIS preparation (Questions and Answers About the NEPA Regulations – 1981 – Question 6).

The environmentally preferred alternative is the Tesoro Route, Option A from Bernice Lake Substation to Pt. Possession, combined with a submarine cable crossing of the Turnagain Arm from Pt. Possession directly to Pt. Woronzof (Route Option C) for a total of 61.3 miles. This route is environmentally preferred because it exhibits on balance, lower overall environmental impacts than the other alternatives, as shown on Table 2-11 in the DEIS.

Any of the other Tesoro Route alternatives would also exhibit overall lower environmental impacts than the Applicant's proposed alternative and other Enstar Route options, primarily because of the impacts of the Enstar route where it crosses the KNWR on the Kenai Peninsula. Route Option B is a submarine cable that includes a crossing of Fire Island that connects with Pt. Woronzof, which would minimize environmental impacts in the Anchorage area. Lower impacts in the Anchorage area for the Tesoro Route alternatives would also result from the underground route from Pt. Campbell to Pt. Woronzof (Route Option N), assuming appropriate mitigation.

### 2.6.3 Applicant's Proposed Alternative

The Applicant's proposed alternative is the Enstar Route, including Route Options E South, F, H, and K (total overall distance of 73.4 miles). The Applicant's primary objective is to select an alternative route for the Southern Intertie Project that meets the purpose and need and represents the best overall combination of high reliability, cost to rate payers, and environmental impacts. In selecting this route as the Applicant's proposal, the Applicant considered these factors.

Exposure of any submarine cable to the extreme tidal conditions in Turnagain Arm creates the risk of cable failures during the life of the Project. Based on bottom and side scan sonar surveys conducted along the proposed submarine cable alternative routes, the Tesoro Route exhibits numerous hazard areas with hard scoured bottom areas and boulder fields, while the Enstar Route further up the Turnagain Arm is composed primarily of mud with no hard bottom or boulder areas. CEA's experience with submarine cables in the Knik Arm since 1967 indicates that a longer cable life and higher reliability can be expected if the submarine cables can be embedded in the sea floor, as opposed to simply laying the cables on the bottom. Bottom conditions along the Tesoro Route precludes economically embedding the cables in the hard bottom and boulder areas and therefore increases the risk of cable failure, while along the Enstar Route the cable can be embedded in the mud bottom for the entire distance. Embedding the cable increases reliability, but cable failures due to shifting sea bottom conditions or other hazards must still be anticipated. Cable replacement is projected twice during the project life for the Tesoro Route, and once for the Enstar Route. A recent example of submarine erosion occurred in mid-2000, when a section of the two Enstar gas pipelines buried in the Turnagain Arm near Burnt Island became exposed as a result of submarine erosion.

As noted in Chapter 1, Sections 1.4.1 and 1.4.2, submarine cable replacement costs were included in the life cycle cost estimates for the project. The Enstar Route is lower in both

constructed cost and life cycle cost than the Tesoro Route, as summarized in Table 1-12 in Chapter 1, Section 1.4.1. Construction costs are lower for Enstar than Tesoro primarily because of the longer submarine cable crossing (13.9 miles for Tesoro Route Option D versus 10.5 miles for Enstar Route Option H) and because of the underground cable segments required for the Tesoro Route from Pt. Campbell to Pt. Woronzof (4 miles, Route Option N) and through the Captain Cook SRA (4.0 miles, Link T5 of Route Option A). Additionally, the cost of submarine cable replacement during the life of the project is higher for Tesoro than Enstar, because the cables would have to be replaced more often for the Tesoro Route. Thus the applicant proposes the Enstar Route over the Tesoro Route on both a reliability and cost basis.

The Applicant's proposed alternative would connect the Soldotna Substation on the Kenai Peninsula with the International Substation in Anchorage. By paralleling the Enstar pipeline, the route would cross the KNWR. An ANILCA application has been filed with the USFWS for this alternative.

**TABLE 2-11A:**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: LAND USE**

| Route | Route Option | Length (miles) | Linear Features (miles) | | | | Jurisdiction (miles) | | | | | | | | | Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pipeline Parallel | Transmission line parallel / rebuild | Railroad parallel | Paved/gravel road parallel | Private | Kenai Peninsula Borough | Municipality of Anchorage (includes private) | State | U.S. Fish and Wildlife Service | Cook Inlet Region Inc. (CIRI) | Salamatof Native Association | Pt. Possession Group | Kenai Native Association | Existing and Future Land Use | Recreation | Summary of Community Working Group Issues | Agency Comments |
| **Bernice Lake to Pt. Possession (Tesoro Route)** | **Route Option A****<br>Links T1, T2, T3, T4, T5, T6, T7, T8, T9 | 44.1 | 27.4 | 0.5 | -- | 16.7 | 4.0 | 33.9 | -- | 5.2 | 1.0 | -- | -- | 1.0 | -- | **Inventory**<br>▪ Adjacent to parcels of residential, commercial, industrial and vacant land<br>▪ Future development in Grey Cliffs and Moose Point Subdivisions<br>▪ Parallels Tesoro Pipeline<br>**Impacts and Mitigation**<br>▪ Underground past airport runways<br>▪ Utilize North Kenai Road right-of-way and transportation corridor<br>▪ **No significant impacts on existing land uses**<br>**Preferred Route Option**<br>▪ Use of North Kenai Road right-of-way, and planned transportation corridor with Kenai Borough will avoid parcels<br>**Preference: 1** | **Inventory**<br>▪ Captain Cook SRA: route crosses through possible future land additions to park<br>**Impacts and Mitigation**<br>▪ Underground next to road through Captain Cook SRA<br>▪ Parallel pipeline and transportation corridor to Point Possession<br>▪ **No significant impacts on recreation uses**<br>**Preferred Route Option**<br>▪ Minimizes impacts on recreation resources<br>▪ Crosses less KNWR<br>**Preference: 1** | **Issues**<br>▪ Preferred route for Kenai and Anchorage CWG<br>▪ Near two local schools<br>▪ Effects on local property values<br>▪ Effects on known and unknown cultural sites (archaeological)<br>**Preference: 1** | **Issues**<br>▪ Preferred route by USFWS due to boundary adjustment for road/utility location<br>▪ KPB concerns about conflicts with subdivided lands<br>▪ Potential disruption to Trumpeter Swan territories<br>▪ LWCF undergrounding requirements through Captain Cook SRA<br>▪ ADOT/PF concerns over location of overhead line within right-of-way |
| **Soldotna to Chickaloon Bay (Enstar Route)** | **Route Option E North/F**<br>Links E1, E2, E3, E4, E8, E9, E10 | 60.1 | 39.8 | 20.9 | -- | 1.5 | 1.9 | 4.1 | -- | 0.4 | 39.1 | 7.3 | 1.6 | -- | 5.7 | **Inventory**<br>▪ Crosses parcels of residential and vacant land<br>▪ 11 airstrips along route<br>▪ Parallels existing 138kV lines<br>▪ Crosses Kenai Native Association conveyed land<br>▪ Crosses KNWR<br>**Impacts and Mitigation**<br>▪ No mitigation necessary for airstrips; avoids conflicts with airspace<br>▪ Disruption to KNWR Fire Management Practices<br>▪ **Significant impacts to KNWR**<br>▪ **No significant impacts on existing land uses**<br>**Least Preferred Route Option**<br>▪ Disruption to residential parcels and Kenai Native Association lands<br>**Preference: 3** | **Inventory**<br>▪ Crosses Moose River at existing transmission line crossing<br>▪ Crosses KNWR<br>**Impacts and Mitigation**<br>▪ Conflicts with KNWR Comprehensive Conservation Plan<br>▪ KNWR Moderate and Minimal Management corridor along Enstar Pipeline<br>▪ **Significant impacts on KNWR**<br>**Least Preferred Route Option**<br>▪ Crosses more KNWR lands<br>**Preference: 3** | **Issues**<br>▪ **Potential impacts on residences**<br>▪ Increased access along Enstar Pipeline route<br>▪ Negative effects on brown bear populations<br>▪ **Impacts to Chickaloon Bay**<br>▪ Cumulative effects to "wilderness values" of upper KNWR<br>▪ **Impacts Kenai Native Association conveyed lands**<br>**Preference: 2** | **Issues**<br>▪ Compatibility with purposes for which KNWR was established<br>▪ **Potential impacts on brown bears, trumpeter swans and waterfowl**<br>▪ Increased access and subsequent management/law enforcement implications<br>▪ Aviation safety concerns<br>▪ Conflicts with existing management practices (i.e., use of prescribed fire for habitat improvement) |

****Environmentally Preferred Route**

**TABLE 2-11A:**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: LAND USE**

| Route | Route Option | Length (miles) | Linear Features (miles) | | | | Jurisdiction (miles) | | | | | | | | | Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pipeline Parallel | Transmission line parallel / rebuild | Railroad parallel | Paved/gravel road parallel | Private | Kenai Peninsula Borough | Municipality of Anchorage (includes private) | State | U.S. Fish and Wildlife Service | Cook Inlet Region Inc. (CIRI) | Salamatof Native Association | Point Possession Group | Kenai Native Association | Existing and Future Land Use | Recreation | Summary of Community Working Group Issues | Agency Comments |
| **Soldotna to Chickaloon Bay (Enstar Route)** | **Route Option E South/F*** Links E5, E6, E7, E8, E9, E10 | 57.5 | 37.8 | 19.0 | -- | 1.5 | 8.8 | 3.1 | -- | 0.6 | 39.6 | 3.7 | 1.7 | -- | -- | **Inventory**<br>▪ Crosses KNWR<br>▪ Crosses parcels of residential, agricultural and vacant land (within existing right-of-way)<br>▪ Seven airstrips along route<br>**Impacts and Mitigation**<br>▪ Mark overhead lines near airstrips, avoids conflicts with airspace<br>▪ Replaces existing 69kV line and utilizes same right-of-way - avoids any additional residential parcel disruption<br>▪ Disruption to KNWR Fire Management Practices<br>▪ **No significant impacts on existing land uses**<br>▪ **Significant Impacts to KNWR**<br>**Preference: 2** | **Inventory**<br>▪ Crosses KNWR<br>▪ Crosses Kenai River at existing transmission line crossings<br>▪ Crosses Funny River State Recreation Site (SRS), and Bing's Landing SRS<br>**Impacts and Mitigation**<br>▪ **No direct physical impact to recreationists or SRSs**<br>▪ Conflicts with KNWR Comprehensive Conservation Plan<br>▪ KNWR Moderate and Minimal Management corridor along Enstar Pipeline<br>▪ **Significant impacts on KNWR**<br>**Preference: 2** | **Issues**<br>▪ Adjacent to residences along Bing's Landing SRS boundary<br>▪ Increased access along Enstar Pipeline Route<br>▪ Effects on brown bear populations<br>▪ Impacts to Chickaloon Bay<br>▪ Cumulative effect to "wilderness values" of KNWR<br>▪ Visual impacts on "wilderness qualities" of KNWR<br>▪ Crossings of Kenai River and impacts on the Kenai River Watershed<br>**Preference: 3** | **Issues**<br>▪ Compatibility with purposes for which KNWR was established<br>▪ Potential impacts on brown bear, trumpeter swans and waterfowl<br>▪ Increased access and subsequent management/law enforcement implications<br>▪ Aviation safety concerns<br>▪ Visual impacts along Kenai River Special Management Area |
| **Northern Soldotna Area (Enstar Route)** | **Route Option E North** Links E1, E2, E3, E4 | 21.6 | 3.8 | 20.9 | -- | 1.5 | 1.9 | 4.1 | -- | 0.2 | 0.8 | 7.3 | 1.6 | -- | 5.7 | **Inventory**<br>▪ Crosses parcels of residential and vacant land<br>▪ 11 airstrips along route<br>▪ Parallels existing 138kV lines<br>▪ Crosses Kenai native association conveyed land<br>**Impacts and Mitigation**<br>▪ No mitigation necessary for airstrips; avoids conflicts with airspace<br>**Least Preferred Route Option**<br>▪ Disruption of residential parcels and Kenai Native Association lands adjacent to existing transmission line<br>**Preference: 2** | **Inventory**<br>▪ Crosses Moose River at existing transmission line crossing<br>▪ Crosses KNWR<br>**Impacts and Mitigation**<br>▪ Conflicts with KNWR Comprehensive Conservation Plan<br>▪ **Potentially significant impacts on KNWR**<br>**Least Preferred Route Option**<br>▪ Would cross additional KNWR lands<br>**Preference: 2** | **Issues**<br>▪ Potential impacts on residences<br>▪ Negative effects on brown bears<br>▪ Impacts to Kenai Native Association conveyed lands<br>**Preference: 1** | **Issues**<br>▪ Aviation safety concerns |

***Applicant's Proposed Route**

**TABLE 2-11A:**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: LAND USE**

| Route | Route Option | Length (miles) | Linear Features (miles) | | | | Jurisdiction (miles) | | | | | | | | | Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pipeline Parallel | Transmission line parallel / rebuild | Railroad parallel | Paved/gravel road parallel | Private | Kenai Peninsula Borough | Municipality of Anchorage (includes private) | State | U.S. Fish and Wildlife Service | Cook Inlet Region Inc. (CIRI) | Salamatof Native Association | Point Possession Group | Kenai Native Association | Existing and Future Land Use | Recreation | Summary of Community Working Group Issues | Agency Comments |
| **Southern Soldotna Area (Enstar Route)** | **Route Option E South*** Links E5, E6, E7 | 19.0 | -- | 19.0 | -- | 1.5 | 8.8 | 3.1 | -- | 0.4 | 1.3 | 3.7 | 1.7 | -- | -- | **Inventory**<br>▪ Existing 69kV right-of-way crosses parcels of residential, agricultural and vacant land<br>▪ Route Option E South replaces existing 69kV line and utilizes same right-of-way<br>▪ Seven airstrips along route<br>**Impacts and Mitigation**<br>▪ Mark overhead lines near airstrips, avoids conflicts with airspace<br>▪ Avoids any new conflicts with residential parcels<br>▪ **No significant impacts on existing land uses**<br>**Preferred Route Option**<br>▪ Avoids disruption to residential parcels<br>**Preference: 1** | **Inventory**<br>▪ Crosses Kenai River at existing transmission line crossings<br>▪ Crosses Funny River SRS, and Bing's Landing SRS<br>**Impacts and Mitigation**<br>▪ **No direct physical impact to recreationists or SRSs**<br>**Preferred Route Option**<br>▪ Crosses less KNWR lands<br>**Preference: 1** | **Issues**<br>▪ Direct impacts on residences along Bing's Landing SRS boundary<br>▪ Crossing of Kenai River and impacts on the Kenai River Watershed<br>**Preference: 2** | **Issues**<br>▪ Aviation safety concerns<br>▪ Visual impacts along Kenai River Special Management Area (SMA) |
| **KNWR (Enstar Route)** | **Route Option F*** Links E8, E9, E10 | 38.5 | 38.5 | -- | -- | -- | -- | -- | -- | 0.2 | 38.3 | -- | -- | -- | -- | **Inventory**<br>▪ Crosses moderate and minimal management areas<br>▪ Parallels existing Enstar pipelines<br>▪ Mystery Creek Road<br>▪ Transportation corridor<br>▪ Two airstrips closed along route; Big Indian Creek Airstrip is open<br>**Impacts and Mitigation**<br>▪ Widens existing transportation corridor<br>▪ Management control on Mystery Creek Road/Enstar pipeline trail<br>▪ Disruption to KNWR Fire Management Practices | **Inventory**<br>▪ Crosses KNWR moderate and minimal management areas<br>▪ Mystery Creek prescribed burn plan<br>▪ Hunter, recreationist, snowmobile use on Mystery Creek Road/Enstar pipeline trail<br>**Impacts and Mitigation**<br>▪ Conflicts with prescribed plan and operations<br>▪ Conflicts with KNWR Comprehensive Conservation Plan<br>▪ Management control on Mystery Creek Road/Enstar pipeline trail<br>▪ Within KNWR | **Issues**<br>▪ Increased access along Enstar Pipeline Route<br>▪ Negative effects on brown bear populations<br>▪ Impacts to Chickaloon Bay<br>▪ Cumulative effect to "wilderness values" of upper KNWR<br>▪ Visual impacts on "wilderness qualities" of upper KNWR | **Issues**<br>▪ Compatibility with purposes for which KNWR was established<br>▪ Potential impacts on brown bears, trumpeter swans and waterfowl<br>▪ Increased access and subsequent management/law enforcement implications<br>▪ Aviation safety concerns<br>▪ Conflicts with existing management practices (i.e., use of prescribed fire for habitat improvement) |

***Applicant's Proposed Route**

**TABLE 2-11A:**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: LAND USE**

| Route | Route Option | Length (miles) | Socioeconomics | Subsistence | Cultural Resources | Visual Resources | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Landscape Scenery | Residential and Recreation Views | Travel Way Views | Summary of Visual Impacts and Mitigation (miles) |
| **Bernice Lake to Pt. Possession (Tesoro Route)** | **Route Option A**** Links T1, T2, T3, T4, T5, T6, T7, T8, T9 | 44.1 | **Impacts and Mitigation**<br>▪ Rate reduction .16/KWh<br>▪ 639 worker months labor average 45, peak 60 workers<br>▪ 196 camp sites, 143 with hook-ups<br>▪ 152 establishments registered to provide lodging can accommodate up to 4,500 visitors<br>▪ Year 1 - 25 workers; Year 2 - 21 workers<br>▪ No environmental justice issues identified<br>▪ Winter construction and advanced planning for construction worker housing will mitigate local impacts on tourism, housing and community resources<br>▪ **No significant impacts**<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ Residents of Ninilchik, Nanwalek, Port Graham, and Seldovia customarily and traditionally hunted moose on the Kenai Peninsula<br>▪ Federal subsistence priorities for those communities are established there<br>▪ By using existing or planned corridors, conflicts between sport and subsistence hunters will be minimized<br>▪ **No significant impacts**<br>**Preference: 1** | **Impacts**<br>▪ **Low to moderate potential impact area**<br>**Preference: 1** | **Local Context**<br>▪ Primarily Scenic Quality B, residential and commercial<br>**Regional Context**<br>▪ Kenai Lowlands, Cook Inlet views toward Mt. Susitna, Redoubt Volcano Aleutian Range | **Views**<br>▪ Immediate foreground and foreground views from residential areas<br>▪ Immediate foreground and foreground views from recreation area (Captain Cook SRA) | **Views**<br>▪ Parallels portions of North Kenai Road | **Impacts**<br>▪ 21.1 miles significant visual impacts<br>**Mitigation**<br>▪ Steel poles will reduce structural contrast<br>▪ At highway and trail crossings towers will be placed at the maximum feasible distance from the crossing<br>▪ "Dulled" metal of corten finish on towers<br>▪ Clearing of right-of-way will be minimized<br>▪ Trees will be removed selectively to blend the edge of the right-of-way into adjacent vegetation patterns<br>▪ Portions of this route option will be underground due to proximity to the flight path of airstrips and Captain Cook SRA<br>**Preferred Route Option**<br>▪ Least amount of significant visual impacts<br>**Preference: 1** |
| **Soldotna to Chickaloon Bay (Enstar Route)** | **Route Option E North/F** Links E1, E2, E3, E4, E8, E9, E10 | 60.1 | **Impacts and Mitigation**<br>▪ Rate reduction .21/KWh<br>▪ 637 worker months of labor - summer peak 90, fall-winter 30<br>▪ 350 campsites, 275 with utility hook-ups<br>▪ July competition with tourism for housing Year 1 and Year 2<br>▪ 18 workers<br>▪ No environmental justice issues identified<br>▪ **No significant impacts**<br>**Preference: 1** | **Same as Route Option A** | **Impacts**<br>▪ **Low to moderate potential impact area**<br>**Least Preferred Route Option**<br>▪ Greatest amount of area with potentially moderate impacts<br>**Preference: 3** | ▪ Same as Route Option E North in combination w/ Route Option F | **Views**<br>▪ Immediate foreground and foreground views from residential areas<br>**Recreation Views**<br>▪ Immediate foreground and foreground views from Moose River Canoe Route<br>▪ Middleground views from Trapper Joe Lake | **Views**<br>▪ Crosses Sterling Highway | **Impacts**<br>▪ 31.2 miles of significant visual impacts<br>**Mitigation**<br>▪ Same as Route Option E North in combination with Route Option F<br>**Least Preferred Route Option**<br>▪ Greatest amount of significant visual impacts<br>**Preference: 3** |
| **Soldotna to Chickaloon Bay (Enstar Route)** | **Route Option E South/F*** Links E5, E6, E7, E8, E9, E10 | 57.5 | **Impacts and Mitigation**<br>▪ Rate reduction .21/KWh<br>▪ 637 worker months of labor - summer peak 90, fall-winter 30<br>▪ 350 campsites, 275 with utility hook-ups<br>▪ July competition with tourism for housing Year 1 and Year 2 - 18 workers<br>▪ No environmental justice issues identified<br>▪ **No significant impacts**<br>**Preference: 1** | **Same as Route Option A** | **Impacts**<br>▪ **Low to moderate potential impact area**<br>**Preference: 2** | ▪ Same as Route Option E South in combination w/ Route Option F | **Views**<br>▪ Immediate foreground and foreground views from residential areas<br>**Recreation Views**<br>▪ Immediate foreground views and foreground views from golf course, campground, Bing's Landing SRA<br>▪ Middleground views from Trapper Joe Lake | **Views**<br>▪ Crosses Sterling Highway | **Impacts**<br>▪ 30.8 miles of significant visual impacts<br>**Mitigation**<br>▪ Same as Route Option E South in combination with Route Option F<br>**Preference: 2** |

***Applicant's Proposed Route**
****Environmentally Preferred Route**

**TABLE 2-11A:**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: LAND USE**

| Route | Route Option | Length (miles) | Socioeconomic | Subsistence | Cultural Resources | Visual Resources | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Landscape Scenery | Residential and Recreation Views | Travel Way Views | Summary of Visual Impacts and Mitigation (miles) |
| **Northern Soldotna Area (Enstar Route)** | **Route Option E North** Links E1, E2, E3, E4 | 21.6 | **Impacts and Mitigation**<br>▪ Rate reduction .21/KWh<br>▪ 637 worker months of labor - summer peak 90, fall-winter 30<br>▪ Soldotna, Sterling, Cooper Landing experience increase demand for housing and community resources<br>▪ 350 campsites, 275 with utility hook-ups<br>▪ July competition with tourism for housing Year 1 and Year 2<br>▪ 18 workers<br>▪ No environmental justice issues identified<br>▪ **No significant impacts**<br>**Preference: 1** | **Same as Route Option A** | **Impacts and Mitigation**<br>▪ **Low to moderate potential impact area**<br>**Least Preferred Route Option**<br>▪ Greatest amount of area with potentially moderate impacts<br>**Preference: 2** | **Local Context**<br>▪ Primarily Scenic Quality B, C, as well as Residential<br>▪ Class B - moderate to densely forested lowlands interspersed with areas of open bottomland and muskeg bogs<br>**Regional Context**<br>▪ Kenai Lowlands | **Views**<br>▪ Immediate foreground and foreground views from residential areas<br>▪ Immediate foreground and foreground views from recreation area (Moose River canoe route) | **Views**<br>▪ Crosses Sterling Highway | **Impacts**<br>▪ 1.0 mile of significant visual impacts<br>**Mitigation**<br>▪ Wood H-frame structures will match spans of existing transmission<br>▪ At highway and trail crossings, towers will be placed at the maximum feasible distance from the crossing<br>▪ Clearing of right-of-way will be minimized<br>▪ Trees will be removed selectively to blend the edge of the right-of-way into adjacent vegetation patterns<br>**Less Preferred Route Option**<br>▪ Greatest amount of significant visual impacts<br>**Preference: 2** |
| **Southern Soldotna Area (Enstar Route)** | **Route Option E South*** Links E5, E6, E7 | 19.0 | **Impacts and Mitigation**<br>▪ Rate reduction .21/KWh<br>▪ 637 worker months of labor - summer peak 90, fall-winter 30<br>▪ 350 campsites, 275 with utility hook-ups<br>▪ July competition with tourism for housing Year 1 and Year 2 - 18 workers<br>▪ No environmental justice issues identified<br>▪ **No significant impacts**<br>**Preference: 1** | **Same as Route Option A** | **Impacts**<br>▪ **Low to moderate potential impact area**<br>**Preference: 1** | **Local Context**<br>▪ Primarily Scenic Quality A, B, C, as well as Residential<br>▪ Class A – Kenai River<br>**Regional Context**<br>▪ Kenai Lowlands | **Views**<br>▪ Immediate foreground and foreground views from residential areas<br>▪ Immediate foreground and foreground views from recreation area (golf course, campgrounds, and Bing's Landing SRA) | **Views**<br>▪ Crosses Sterling Highway | **Impacts**<br>▪ 0.57 mile of significant visual impacts<br>**Mitigation**<br>▪ Steel poles will be used to reduce structural contrast<br>▪ At highway and trail crossings, towers will be placed at the maximum feasible distance from the crossing<br>▪ "Dulled" metal or corten finish on towers will be used to reduce visual impacts<br>▪ Trees will be removed selectively to blend the edge of the right-of-way into adjacent vegetation patterns<br>**Preferred Route Option**<br>▪ Least amount of significant visual impacts<br>**Preference: 1** |
| **Enstar to Chickaloon Bay (Enstar Route)** | **Route Option F*** Links E8, E9, E10 | 38.5 | **Impacts and Mitigation**<br>▪ Rate reduction .21/KWh<br>▪ 637 worker months of labor - summer peak 90, fall-winter 30<br>▪ 350 campsites, 275 with utility hook-ups<br>▪ July competition with tourism for housing Year 1 and Year 2 - 18 workers<br>▪ No environmental justice issues identified<br>▪ **No significant impacts** | **Same as Route Option A** | **Impacts**<br>▪ **Low to moderate potential impact area** | **Local Context**<br>▪ Primarily Scenic Quality A, including the foothills of the Central Kenai Mountains, the Chickaloon Bay tidal estuary and major wetlands/ drainages<br>**Regional Context**<br>▪ Kenai Ranges Bordering Flats, Turnagain Arm | **Views**<br>▪ Middleground views from Trapper Joe Lake | **Views**<br>▪ Parallels Mystery Creek Road/Enstar pipeline trail | **Impacts**<br>▪ 30.2 miles of significant visual impacts<br>**Mitigation**<br>▪ Wood poles will reduce structural contrast<br>▪ "Dulled" metal or corten finish on towers will be used to reduce visual impacts<br>▪ Clearing of right-of-way will be minimized<br>▪ Trees will be removed selectively to blend the edge of the right-of-way into adjacent vegetation patterns |

***Applicant's Proposed Route**

**TABLE 2-11A**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: GEOLOGY AND VEGETATION**

| Route | Route Option | Length (miles) | Geologic, Water and Marine Resources | Drainage Basins and Watersheds | Terrestrial Vegetation | |
|---|---|---|---|---|---|---|
| | | | | | **Wetlands** | **Upland Vegetation** |
| **Bernice Lake to Pt. Possession (Tesoro Route)** | **Route Option A**** Links T1, T2, T3, T4, T5, T6, T7, T8, T9 | 44.1 | **Inventory, Impacts, and Mitigation**<br>▪ 0.9 mile with compressible materials - mitigated by existing road access, use of tracked and low ground pressure vehicles and special equipment, season-specific construction<br>▪ 0.1 mile prone to slope instability – structural integrity impacts mitigated by cased boring<br>▪ Impacts on Capt. Cook SRA avoided by undergrounding transmission line<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Minimizes stream crossings, potential watershed disruption, compressible material compaction in the Kenai Lowlands, and avoids the Kenai and Chickaloon River watersheds<br>**Preference: 1** | **Inventory, Impacts, and Mitigation**<br>▪ Streams and associated floodplains crossed<br>- Bishop Creek<br>- Swanson River<br>- Scaup Creek<br>- Otter Creek<br>- Seven Egg Creek<br>- Miller Creek<br>▪ 6 stream crossings - mitigated by planned spanning, setting foundations and structures back from sensitive banks and riparian areas, season-specific scheduling, temporary man-made and ice bridging<br>▪ 0.6 mile of 100-year floodplain crossed - mitigated by planned spanning, setting foundations and structures back from sensitive banks and riparian areas, season-specific scheduling, temporary man-made and ice bridging<br>▪ Flood zones generally 500 to 700 feet wide<br>▪ Swanson River mitigated by suspending beneath bridge or boring under river<br>▪ **No significant impacts** | **Inventory**<br>▪ 77.6 acres of bogs and meadows affected<br>**Impacts and Mitigation**<br>▪ Winter construction<br>▪ Spanning low-growing vegetation<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Minimizes potential impacts on wetlands in the Kenai Lowlands<br>**Preference: 1** | **Inventory**<br>▪ 443.1 acres of closed mixed forest affected<br>▪ 1.3 acres of closed tall shrub affected<br>**Impacts and Mitigation**<br>▪ Spruce bark beetle mitigation<br>▪ Spanning low-growing vegetation<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Minimizes upland vegetation clearing<br>**Preference: 1** |
| **Soldotna to Chickaloon Bay (Enstar Route)** | **Route Option E North/F** Links E1, E2, E3, E4, E8, E9, E10 | 60.1 | **Inventory, Impacts, and Mitigation**<br>▪ 12.4 miles compressible materials - mitigated by existing gravel road (Links E1, E3, and E4) and utility corridor (Link E1); access to tower locations via road with limited disturbance to riparian area; use of tracked and low ground pressure vehicles and special equipment, season-specific construction<br>▪ **No significant impacts**<br>**Preference : 2** | **Inventory, Impacts, and Mitigation**<br>▪ Streams and associated floodplains crossed<br>- see Route Options E North and F<br>▪ 25 stream crossings – mitigated: see Route Option A<br>▪ 1.5 mile 100-year floodplain – mitigated: see Route Option A<br>▪ Flood zones range from 100 to 1,300 feet wide<br>▪ **No significant impacts** | **Inventory**<br>▪ 131.6 acres of bogs and meadows affected<br>▪ 72.2 acres of black spruce forest affected<br>**Impacts and Mitigation**<br>▪ Winter construction (Links E8, E9, E10)<br>▪ Spanning low-growing vegetation<br>▪ **Significant impacts on wetlands on KNWR – Route Option F**<br>▪ **No significant impacts on Route Option E North**<br>**Least Preferred Route Option**<br>▪ Crosses greatest amount of wetland area<br>**Preference: 3** | **Inventory**<br>▪ 191.7 acres of closed white spruce affected<br>▪ 476.2 acres of closed mixed forest affected<br>▪ 18.9 acres of needle leaf woodland affected<br>▪ 14.3 acres of moist grassland affected<br>**Impacts and Mitigation**<br>▪ Spruce bark beetle mitigation<br>▪ **Significant impacts on upland vegetation on KNWR**<br>**Least Preferred Route Option**<br>▪ Results in the most upland vegetation clearing<br>**Preference: 3** |
| **Soldotna to Chickaloon Bay (Enstar Route)** | **Route Option E South/F*** Links E5, E6, E7, E8, E9, E10 | 57.5 | **Inventory, Impacts, and Mitigation**<br>▪ 9.9 miles compressible materials - mitigated by existing road access (Links T4 and T5); use of tracked and low ground pressure vehicles and special equipment<br>▪ **No significant impacts**<br>**Least Preferred Route Option**<br>▪ While this route crosses more 100-year floodplain, streams and compressible materials, Route Option B South crosses the Kenai River in two locations as well as the Funny River. Due to the concerns for the protection of the Kenai River, this option would be less preferable. Due to the proposal to replace an existing power line without additional right-of-way clearing, set towers back from the riverbanks and construction during winter; however, any potential impacts will be mitigated.<br>**Preference: 3** | **Inventory, Impacts, and Mitigation**<br>▪ Streams and associated floodplains crossed<br>- see Route Options E South and F<br>▪ 22 stream crossings – mitigated: see Route Option A<br>▪ 0.8 mile 100-year floodplain – mitigated: see Route Option A<br>▪ Flood zones generally 300 to 1,300 feet wide<br>▪ **No significant impacts** | **Inventory**<br>▪ 62.5 acres of bogs and meadows affected<br>▪ 72.2 acres of black spruce forest affected<br>**Impacts and Mitigation**<br>▪ Winter construction (Links E5, E8, E9, E10)<br>▪ Spanning low-growing vegetation<br>▪ **Significant impacts on wetlands on KNWR – Route Option F**<br>▪ **No significant impacts on Route Option E South**<br>**Preference: 2** | **Inventory**<br>▪ 191.7 acres of closed white spruce forest affected<br>▪ 337.7 acres of closed mixed forest affected<br>▪ 14.3 acres of moist grassland affected<br>**Impacts and Mitigation**<br>▪ Spruce bark beetle mitigation<br>▪ **Significant impacts on upland vegetation on KNWR**<br>**Preference: 2** |

***Applicant's Proposed Route**
****Environmentally Preferred Route**

**TABLE 2-11A**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: GEOLOGY AND VEGETATION**

| Route | Route Option | Length (miles) | Geologic, Water and Marine Resources | Drainage Basins and Watersheds | Terrestrial Vegetation | |
|---|---|---|---|---|---|---|
| | | | | | Wetlands | Upland Vegetation |
| **Northern Soldotna Area (Enstar Route)** | **Route Option E North** Links E1, E2, E3, Er | 21.6 | **Inventory, Impacts, and Mitigation**<br>▪ 7.7 miles with compressible materials - mitigated: see Route Option E North/F<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Avoids Kenai River crossings<br>**Preference: 1** | **Inventory, Impacts, and Mitigation**<br>▪ Streams and associated floodplains crossed<br>- Soldotna Creek (3 crossings)<br>- Unnamed Creeks (2 crossings)<br>- Moose River<br>▪ 6 stream crossings – mitigated: see Route Option A<br>▪ 1.1 miles of 100-year floodplain – mitigated: see Route Option A<br>▪ Flood zones generally 300 to 1,300 feet wide<br>▪ **No significant impacts** | **Inventory**<br>▪ 74.6 acres of bogs and meadows affected<br>**Impacts and Mitigation**<br>▪ Winter construction<br>▪ Spanning low-growing vegetation<br>▪ **No significant impacts**<br>**Least Preferred Route Option**<br>▪ Crosses greatest amount of wetland area<br>**Preference: 2** | **Inventory**<br>▪ 150.2 acres of closed mixed forest affected<br>▪ 18.9 acres of needleleaf woodland affected<br>**Impacts and Mitigation**<br>▪ Spruce bark beetle mitigation<br>▪ **No significant impacts**<br>**Least Preferred Route Option**<br>▪ Upland vegetation clearing required<br>**Preference: 2** |
| **Southern Soldotna Area (Enstar Route)** | **Route Option E South*** Links E5, E6, E7 | 19.0 | **Inventory, Impacts, and Mitigation**<br>▪ 4.7 miles compressible materials – mitigated: see Route Option E South/F<br>▪ **No significant impacts**<br>**Less Preferred Route Option**<br>▪ Crosses Kenai River; see Route Option E South/F<br>**Preference: 2** | **Inventory, Impacts, and Mitigation**<br>▪ Two Kenai River crossings, Funny River crossed also – mitigated: see Route Option A<br>▪ 0.4 mile 100-year floodplain – mitigated: see Route Option A<br>▪ **No significant impacts** | **Inventory**<br>▪ 5.5 acres of bogs and meadows affected<br>**Impacts and Mitigation**<br>▪ Winter construction<br>▪ Spanning low-growing vegetation<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Crosses the least amount of wetland area<br>**Preference: 1** | **Inventory**<br>▪ 11.7 acres of closed mixed forest affected<br>**Impacts and Mitigation**<br>▪ Spruce bark beetle mitigation for any tree removal required<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Minimizes right-of-way clearing by replacing existing transmission line<br>▪<br>**Preference: 1** |
| **KNWR (Enstar Route)** | **Route Option F*** Links E8, E9, E10 | 38.5 | **Inventory, Impacts, and Mitigation**<br>▪ 0.9 mile with compressible materials - mitigated: see Route Option E South/F<br>▪ **No significant impacts** | **Inventory, Impacts, and Mitigation**<br>▪ Streams and associated floodplains crossed<br>- Moose River Drainage Basin (4 crossings)<br>East Fork Moose River<br>3 unnamed tributaries<br>- Chickaloon River Drainage Basin (7 crossings)<br>Mystery Creek<br>Chickaloon River<br>5 unnamed tributaries of the Chickaloon River<br>- Big Indian Creek Drainage Basin<br>- Little Indian Creek Drainage Basin<br>- Burnt Island Creek Drainage Basin<br>▪ 19 stream crossings – mitigated: see Route Option A<br>▪ 0.4 mile of 100-year floodplain – mitigated: see Route Option A<br>▪ Flood zones generally 100 to 600 feet wide<br>▪ **No significant impacts** | **Inventory**<br>▪ 57.0 acres of bogs and meadows affected<br>▪ 72.2 acres of black spruce forest affected<br>**Impacts and Mitigation**<br>▪ Winter construction<br>▪ Spanning low-growing vegetation<br>▪ **Significant impacts on wetlands on KNWR due to potential wetland compaction or removal of black spruce** | **Inventory**<br>▪ 191.7 acres of closed white spruce forest affected<br>▪ 326.0 acres of closed mixed forest affected<br>▪ 14.3 acres of moist grassland affected<br>**Impacts and Mitigation**<br>▪ Spruce bark beetle mitigation<br>▪ **Significant impacts due to clearing upland vegetation on KNWR** |

***Applicant's Proposed Route**

**TABLE 2-11A**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: WILDLIFE RESOURCES**

| Route | Route Option | Length (miles) | Wildlife Selected Resources | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Anadromous Fish** | **Birds (Bald Eagle, Trumpeter Swan, General Waterfowl)** | **Large Mammals (Moose, Caribou, Brown and Black Bear)** | **Predators (Gray Wolf, Canada Lynx)** | **Beluga Whale** | **Threatened and Endangered Species** |
| **Bernice Lake to Pt. Possession (Tesoro Route)** | **Route Option A**** Links T1, T2, T3, T4, T5, T6 T7, T8, T9 | 44.1 | **Inventory**<br>▪ 4 anadromous fish stream crossings<br>**Impacts and Mitigation**<br>▪ Directional boring at Swanson River<br>▪ All other anadromous fish streams spanned<br>▪ Winter construction north of Captain Cook SRA<br>▪ Erosion control along right-of-way to protect watershed following construction<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Minimizes streams crossed<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ Very limited disturbance to nesting waterfowl (north of Pt. Possession Transition Facility) - **no significant impacts**<br>▪ No disturbance to nesting waterfowl on remainder of route (late summer/fall/winter construction)<br>▪ Clearing within 0.25 mile of 3 bald eagle nests - selective tree removal – **potential for locally significant impacts (seasonal construction and selective clearing provide for mitigation)**<br>▪ Collision hazard (especially T1-T4, high density of large lakes, wire marking at stream crossings and near water) - **potential for locally significant impacts**<br>**Preference: 2** | **Impacts and Mitigation**<br>▪ Clearing of black bear habitat - **no significant impacts**<br>▪ Clearing of moose winter range/creation of new winter range - **no significant impacts**<br>▪ Limited increase in disturbance and human/brown bear conflicts<br>▪ On periphery of brown bear use, in area of potential future development - **no significant impacts**<br>**Preferred Route Option**<br>▪ Periphery of brown bear use in region<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ Potential for increased harvest of lynx and wolves (Links T7, T8, T9) in minimal abundance area and area of potential future development - **no significant impacts**<br>▪ Clearing in lynx denning habitat **(no significant impacts)**<br>▪ Creation of habitat for prey species - **no significant impacts**<br>**Preferred Route Option**<br>▪ Impacts within an area of future development<br>**Preference: 1** | **Inventory**<br>▪ No beluga whale habitat<br>**Impacts**<br>▪ Not a factor in route comparison | **Inventory**<br>▪ No habitat for threatened or endangered species<br>**Impacts**<br>▪ Not a factor in comparison |
| **Soldotna to Chickaloon Bay (Enstar Route)** | **Route Option E North/F** Links E1, E2, E3, E4, E8, E9, E10 | 60.1 | **Inventory**<br>▪ 10 anadromous fish stream crossings<br>**Impacts and Mitigation**<br>▪ All streams spanned<br>▪ Winter construction in KNWR (Route Option F), late summer/fall construction on Route Option E North<br>▪ Erosion control along right-of-way to protect watershed following construction<br>▪ **No significant impacts**<br>**Preference: 2** | **Impacts and Mitigation**<br>▪ No disturbance to nesting waterfowl – late summer/fall/winter construction - **no impacts**<br>▪ Collision hazard - Route Option E North, high density of lakes, Moose River - wire marking at stream crossings and near water - **potential for locally significant impacts off KNWR - potential for nationally significant impacts on KNWR**<br>▪ Clearing within 0.25 mile of 2 bald eagle nests – selective tree removal - **locally significant impacts off KNWR, nationally significant impacts on KNWR**<br>**Least Preferred Route Option**<br>▪ Higher collision potential due to adjacent lakes and Moose River Crossing<br>**Preference: 3** | **Impacts and Mitigation**<br>▪ Clearing of black bear habitat - **nationally significant impacts on KNWR**<br>▪ Clearing of moose winter range/ creation of new winter range - **nationally significant impacts on KNWR**<br>▪ Increased disturbance and human/brown bear conflicts due to increased access north of Mystery Creek on protected lands of KNWR, in the mountains/lowlands interface - **nationally significant impacts**<br>**Preference: 2** | **Impacts and Mitigation**<br>▪ Potential for increased harvest north of Mystery Creek on protected lands of KNWR – **nationally significant impacts**<br>▪ Clearing in lynx denning habitat - **nationally significant on KNWR**<br>▪ Creation of habitat for prey - **no significant impacts**<br>**Preference: 2** | **Same as Route Option A** | **Same as Route Option A** |
| **Soldotna to Chickaloon Bay (Enstar Route)** | **Route Option E South/F*** Links E5, E6, E7, E8, E9, E10 | 57.5 | **Inventory**<br>▪ 10 anadromous fish stream crossings<br>**Impacts and Mitigation**<br>▪ All streams spanned<br>▪ Winter construction<br>▪ Erosion control along right-of-way to protect watershed following construction<br>▪ **No significant impacts**<br>**Least Preferred Route Option**<br>▪ Crosses Kenai River, making this route more sensitive, although construction will not occur within the river corridor or river banks<br>**Preference: 3** | **Impacts and Mitigation**<br>▪ No disturbance to nesting waterfowl (late summer/fall/winter construction) - **no impacts**<br>▪ Collision hazard, especially Route E South (fewer lakes than E North) - wire marking at stream crossings and near water - **potential for locally significant impacts off KNWR, potential for nationally significant impacts on KNWR**<br>▪ Clearing within 0.25 mile of 4 bald eagle nests, very limited at E South due to limited tree removal requirements on Route Option E South - **no significant impacts on E South, potential for nationally significant impacts on KNWR, Route Option F**<br>**Preferred Route Option**<br>▪ Lower collision potential due to least number of lakes in proximity to the route<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ Clearing of black bear habitat - **nationally significant impacts on KNWR**<br>▪ Clearing of moose winter range/creation of new winter range - **nationally significant impacts on KNWR**<br>▪ Increased disturbance and human/brown bear conflicts due to increased access north of Mystery Creek on protected lands of KNWR, in the mountains/lowlands interface - **nationally significant impacts**<br>**Preference: 2** | **Impacts and Mitigation**<br>▪ Increased harvest north of Mystery Creek on protected lands of KNWR - **nationally significant impacts**<br>▪ Clearing in lynx denning habitat - **nationally significant on KNWR**<br>▪ Creation of habitat for prey - **no significant impacts**<br>**Preference: 2** | **Same as Route Option A** | **Same as Route Option A** |

***Applicant's Proposed Route**
****Environmentally Preferred Route**

**TABLE 2-11A**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**KENAI LOWLANDS: WILDLIFE RESOURCES**

| Route | Route Option | Length (miles) | Wildlife Selected Resources | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Anadromous Fish** | **Birds (Bald Eagle, Trumpeter Swan, General Waterfowl)** | **Large Mammals (Moose, Caribou, Brown and Black Bear)** | **Predators (Gray Wolf, Canada Lynx)** | **Beluga Whale** | **Threatened and Endangered Species** |
| **Northern Soldotna Area (Enstar Route)** | **Route Option E North** Links E1, E2, E3, E4 | 21.6 | **Inventory**<br>▪ 3 anadromous fish stream crossings<br>**Impacts and Mitigation**<br>▪ Streams will be spanned<br>▪ Winter construction<br>▪ Erosion control along right-of-way to protect watershed following construction<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Avoids Kenai River crossings<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ No disturbance to nesting waterfowl (late summer/fall construction) - **no significant impacts**<br>▪ Collision hazard (high density of lakes, Moose River) - wire marking at stream crossings and near water - **potential for locally significant impacts**<br>▪ Clearing within 0.25 mile of 1 bald eagle nest - selective tree removal - **no significant impacts**<br>**Preference: 2** | **Impacts and Mitigation**<br>▪ Clearing of black bear habitat - **no significant impacts**<br>▪ Clearing of moose winter range/creation of new winter range - **no significant impacts**<br>▪ No increased human access<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ No increased harvest expected<br>▪ Clearing in lynx denning habitat - **no significant impacts**<br>▪ Creation of habitat for prey species - **no significant impacts**<br>**Preference: 1** | **Same as Route Option A** | **Same as Route Option A** |
| **Southern Soldotna Area (Enstar Route)** | **Route Option E South*** Links E5, E6, E7 | 19.0 | **Inventory**<br>▪ 3 anadromous fish stream crossings<br>**Impacts and Mitigation**<br>▪ All streams spanned<br>▪ Winter construction<br>▪ Erosion control along right-of-way to protect watershed following construction<br>▪ **No significant impacts**<br>**Less Preferred Route**<br>▪ Kenai River crossings make this route more sensitive than Route Option E North, although construction would not occur within the river corridor or river banks<br>**Preference: 2** | **Impacts and Mitigation**<br>▪ No disturbance to nesting waterfowl (later summer/fall/winter construction) - **no impacts**<br>▪ Collision hazard (fewer lakes than E North) - wire marking at stream crossing and near water - **potential for locally significant impacts**<br>▪ Very limited clearing within 0.25 mile of 3 bald eagle nests - selective tree removal - **no significant impacts**<br>**Preferred Route Option**<br>▪ See Route Option E South/F<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ Very limited clearing in black bear and moose habitats - **no significant impacts**<br>▪ Clearing of moose winter range/creation of new winter range - **no significant impacts**<br>▪ No increase in human access<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ No increased harvest expected<br>▪ Very limited clearing in lynx denning habitat - **no significant impacts**<br>▪ No creation of additional prey habitat<br>**Preference: 1** | **Same as Route Option A** | **Same as Route Option A** |
| **KNWR (Enstar Route)** | **Route Option F*** Links E8, E9, E10 | 38.5 | **Inventory**<br>▪ 7 anadromous fish stream crossings within KNWR<br>**Impacts and Mitigation**<br>▪ All streams will be spanned<br>▪ Winter construction<br>▪ Erosion control along right-of-way to protect watershed following construction<br>▪ **No significant impacts** | **Impacts and Mitigation**<br>▪ No disturbance to nesting waterfowl (winter construction) - **no impacts**<br>▪ Very limited collision hazard on KNWR (few lakes) - wire marking at stream crossings and near water - **potential for nationally significant impacts**<br>▪ Clearing within 0.25 mile of 1 bald eagle nest on KNWR - selective tree removal - **potential for nationally significant impacts** | **Impacts and Mitigation**<br>▪ Clearing of black bear habitat on KNWR - **nationally significant impacts**<br>▪ Clearing of moose winter range/creation of new winter range on KNWR - **no significant impacts**<br>▪ Increased disturbance and human/bear conflicts due to increased human access north of Mystery Creek on protected lands of KNWR, in mountains/lowlands interface - **nationally significant impacts** | **Impacts and Mitigation**<br>▪ Potential for increased harvest north of Mystery Creek on protected lands of KNWR - **nationally significant impacts**<br>▪ Clearing in lynx denning habitat on KNWR - **nationally significant impacts**<br>▪ Creation of habitat for prey - **no significant impacts** | **Same as Route Option A** | **Same as Route Option A** |

***Applicant's Proposed Route**

**TABLE 2-11B**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**TURNAGAIN ARM: LAND USE**

| Route | Route Option | Length (miles) | Linear Features (miles) | | | | Jurisdiction (miles) | | | | | | | | Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pipeline Parallel | Transmission line parallel/ rebuild | Railroad parallel | Paved/gravel road parallel | Private | Kenai Peninsula Borough | Municipality of Anchorage (includes private) | State | U.S. Fish and Wildlife Service | Cook Inlet Region Inc. (CIRI) | Salamatof Native Association | Pt. Possession Group | Kenai Native Association | Existing and Future Land Use | Recreation | Summary of Community Working Group Issues | Agency Comments |
| **Pt. Possession to Pt. Campbell (Tesoro Route)** | **Route Option D**<br>Links T16, T17 | 13.9 | 13.9 | -- | -- | -- | -- | -- | -- | 3.4 | -- | -- | -- | 0.1 | -- | **Inventory**<br>■ Pt. Possession and Pt. Campbell landings<br>■ Potential future development at Pt. Possession<br>■ Crosses open water<br>**Impacts and Mitigation**<br>■ **No land use impacts**<br>■ Compliance with KPB Coastal Management Plan (CMP)<br>**Preference: 1** | **Inventory**<br>■ Kincaid Park at Anchorage landing crosses ACWR<br>**Impacts and Mitigation**<br>■ **No recreation impacts** | ■ CIRI supports use of Fire Island route<br>■ Potential for future development would be improved with electricity<br>■ Impacts to private lands along coastline (Pt. Possession Village) | ■ Impacts to ACWR<br>■ Compliance with KPB CMP<br>■ Avoid interference with FAA navigation sites located on Fire Island |
| **Pt. Possession to Pt. Woronzof via Fire Island (Tesoro Route)** | **Route Option B**<br>Links T10, T11, T12, T13, T14 | 19.1 | -- | -- | -- | -- | -- | -- | 0.1 | 0.3 | -- | 4.9 | -- | 0.1 | -- | **Inventory**<br>■ Pt. Possession and Pt. Woronzof landings<br>■ Potential future development at Pt. Possession<br>■ Crosses open water<br>■ Crosses Fire Island, uses existing roads<br>■ VORTAC facilities on island<br>**Impacts and Mitigation**<br>■ Compliance with Federal Aviation Administration (FAA) regulations to avoid impacts with VORTAC<br>■ Compliance with KPB CMP<br>■ **No land use impacts**<br>**Preference: 2** | **Inventory**<br>■ Kincaid Park at Anchorage landing crosses ACWR<br>**Impacts and Mitigation**<br>■ **No recreation impacts**<br>**Preference: 1** | ■ CIRI supports use of Fire Island route<br>■ Potential for future development would be improved with electricity<br>■ Impacts to private lands along coastline (Pt. Possession Village) | ■ Impacts to ACWR<br>■ Compliance with KPB CMP<br>■ Avoid interference with FAA navigation sites located on Fire Island |
| **Pt. Possession to Pt. Woronzof (Tesoro Route)** | **Route Option C****<br>Link T15 | 17.2 | 3.8 | -- | -- | -- | -- | -- | 0.2 | 3.9 | -- | -- | -- | 0.1 | -- | **Inventory**<br>■ Similar to Route Option D except lands at Pt. Woronzof in Anchorage<br>**Preference: 1** | **Inventory**<br>■ Similar to Route Option B<br>**Preference: 1** | ■ Preferred submarine route from Anchorage CWG viewpoint<br>■ Avoids impacts to Anchorage Bowl | ■ Requires compliance with KPB CMP<br>■ Impacts to ACWR |

****Environmentally Preferred Route**

**TABLE 2-11B**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**TURNAGAIN ARM: LAND USE**

| Route | Route Option | Length (miles) | Linear Features (miles) | | | | Jurisdiction (miles) | | | | | | | | Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pipeline Parallel | Transmission line parallel/ rebuild | Railroad parallel | Paved/gravel road parallel | Private | Kenai Peninsula Borough | Municipality of Anchorage (includes private) | State | U.S. Fish and Wildlife Service | Cook Inlet Region Inc. (CIRI) | Salamatof Native Association | Pt. Possession Group | Kenai Native Association | Existing and Future Land Use | Recreation | Summary of Community Working Group Issues | Agency Comments |
| **Chickaloon Bay to Klatt Road (Enstar Route)** | **Route Option G** Link E11 | 11.2 | -- | -- | -- | -- | -- | -- | -- | 4.2 | 0.8 | -- | -- | -- | -- | **Inventory**<br>■ Chickaloon Bay and Klatt Road landings<br>**Impacts and Mitigation**<br>■ **No land use impacts**<br>**Preference: 1** | **Inventory**<br>■ Crosses ACWR<br>**Impacts and Mitigation**<br>■ No recreation impacts<br>**Preference: 1** | ■ Concern over impacts to Chickaloon Bay<br>■ Effects to ACWR | ■ Compliance with KPB CMP<br>■ Impacts to ACWR |
| **Chickaloon Bay to Oceanview Park (Enstar Route)** | **Route Option H*** Link E12 | 10.5 | -- | -- | -- | -- | -- | -- | -- | 3.4 | 0.8 | -- | -- | -- | -- | **Inventory**<br>■ Chickaloon Bay and Oceanview Park/Alaska Railroad<br>**Impacts and Mitigation**<br>■ **No land use impacts**<br>**Preference: 1** | **Inventory**<br>■ Oceanview Bluff Park<br>■ Crosses ACWR<br>**Impacts and Mitigation**<br>■ **Short-term construction impacts**; mitigation will replace/repair facilities<br>■ Potential short-term conflict with Rabbit Creek Shooting Range during construction<br>**Preference: 1** | ■ Impacts to ACWR and Oceanview Bluff Park<br>■ Visual impacts associated with transition station | ■ Compliance with KPB CMP<br>■ Conflict with expansion of Alaska Department of Fish and Game (ADF&G) shooting range during construction<br>■ Impacts to ACWR |
| **Chickaloon Bay to Rabbit Creek (Enstar Route)** | **Route Option I** Link E13 | 9.0 | -- | -- | -- | -- | -- | -- | -- | 1.7 | 0.8 | -- | -- | -- | -- | **Inventory**<br>■ Chickaloon Bay to Rabbit Creek/Alaska Railroad landing<br>■ Crosses open water<br>**Impacts and Mitigation**<br>■ **No land use impacts**<br>**Preference: 1** | **Inventory**<br>■ Crosses ACWR<br>**Impacts and Mitigation**<br>■ Potential short-term conflict with Rabbit Creek Shooting Range during construction<br>**Preference: 1** | | ■ Compliance with KPB CMP<br>■ Impacts to ACWR |

***Applicant's Proposed Route**

**TABLE 2-11B**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**TURNAGAIN ARM: SOCIEOCONOMIC, SUBSISTENCE, CULTURAL, AND VISUAL**

| Route | Route Option | Length (miles) | Socioeconomic | Subsistence | Cultural Resources | Visual Resources | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Landscape Scenery | Residential and Recreation Views | Travel Way Views | Summary of Visual Impacts and Mitigation (miles) |
| **Pt. Possession to Pt. Campbell (Tesoro Route)** | **Route Option D**<br>Links T16, T17 | 13.9 | **Impacts and Mitigation**<br>■ Rate reduction .16/KWh<br>■ Peak workforce 90 workers, 164 worker months construction labor plus 261 worker months as submerged segment<br>■ 75 non-local workers<br>■ $3.8 million in wages and salaries for Turnagain Arm and Anchorage options<br>■ No environmental justice issues identified<br>■ **No significant impacts** | N/A | **Impacts**<br>■ Low potential impact area<br>**Preferred Route Option**<br>■ Least amount of area with potential impacts<br><br>**Preference: 1** | **Local Context**<br>■ Scenic Quality Class B, tidal mudflats, coastal bluffs<br>■ Park-like image type along T17<br>**Regional Context**<br>■ Cook Inlet, Turnagain Arm, Knik Arm | **Views**<br>■ Foreground views from recreation area (Kincaid Park) | N/A | **Impacts**<br>■ **No significant visual impacts** – submarine cable<br>■ Not a factor in route comparison |
| **Pt. Possession to Pt. Woronzof via Fire Island (Tesoro Route)** | **Route Option B**<br>Links T10, T11, T12, T13, T14 | 19.1 | **Same as Route Option D** | N/A | **Impacts**<br>■ Low to moderate potential impact area<br><br>**Preference: 3** | **Local Context**<br>■ Fire Island, Scenic Quality Class A and B:<br>Class A: steep cliffs and tidal mudflats making up the island coastline<br>Class B: relatively flat topography, mixed conifer forests<br>■ Pt. Campbell: Class A – dense grasslands interspersed with wetlands<br>■ Park-like image type along T14<br>**Regional Context**<br>■ Cook Inlet, Turnagain Arm, Knik Arm | **Views**<br>■ Foreground views from recreation area (Kincaid Park) | N/A | **Same as Route Option D** |
| **Pt. Possession to Pt. Woronzof (Tesoro Route)** | **Route Option C****<br>Link T15 | 17.2 | **Same as Route Option D** | N/A | **Impacts**<br>■ Low to moderate potential impact area<br><br>**Preference: 2** | **Local Context**<br>■ Pt. Woronzof: Scenic Quality Class A<br>■ Park-like image type along T15<br>**Regional Context**<br>■ Cook Inlet, Turnagain Arm, Knik Arm | **Views**<br>■ Immediate foreground views from recreation area (Tony Knowles Coastal Trail, Kincaid Park) | N/A | **Same as Route Option D** |

****Environmentally Preferred Route**

**TABLE 2-11B**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**TURNAGAIN ARM: SOCIEOCONOMIC, SUBSISTENCE, CULTURAL, AND VISUAL**

| Route | Route Option | Length (miles) | Socioeconomic | Subsistence | Cultural Resources | Visual Resources | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Landscape Scenery | Residential and Recreation Views | Travel Way Views | Summary of Visual Impacts and Mitigation (miles) |
| **Chickaloon Bay to Klatt Road (Enstar Route)** | **Route Option G** Link E11 | 11.2 | **Impacts and Mitigation**<br>■ Rate reduction .21/KWh<br>■ Peak workforce 100 workers, 170 worker months construction labor plus 223 worker months in submerged segment<br>■ 75 non-local workers<br>■ $7 million in wages and salaries for Turnagain Arm plus Anchorage options<br>■ No environmental justice issues identified<br>■ **No significant impacts** | N/A | **Impacts**<br>■ Low potential impact area<br>**Preference: 1** | **Local Context**<br>■ Mostly submarine; however, Scenic Quality Class A landscape exists at Chickaloon Bay and the southern edge of Anchorage – coastal marshes interspersed with small drainages, wetlands, and tidal mudflats<br>**Regional Context**<br>■ Cook Inlet, Turnagain Arm, Knik Arm | **Views**<br>■ Foreground views from residential areas | N/A | **Same as Route Option D** |
| **Chickaloon Bay to Oceanview (Enstar Route)** | **Route Option H*** Link E12 | 10.5 | **Same as Route Option G** | N/A | **Impacts**<br>■ Low potential impact area<br>**Least Preferred Route Option**<br>■ Greatest amount of an area with potential impacts<br>**Preference: 2** | **Same as Route Option G** | **Views**<br>■ Immediate foreground and foreground views from residential areas<br>■ Immediate foreground and foreground views from recreation areas (Oceanview Bluff Park, Oceanview Park) | N/A | **Same as Route Option D** |
| **Chickaloon Bay to Rabbit Creek (Enstar Route)** | **Route Option I** Link E13 | 9.0 | **Same as Route Option G** | N/A | **Impacts**<br>■ Low potential impact area<br>**Preference: 1** | **Same as Route Option G** | **Views**<br>■ Foreground views from recreational area (Rabbit Creek Rifle Range) | N/A | **Same as Route Option D** |

***Applicant's Proposed Route**

**TABLE 2-11B**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**TURNAGAIN ARM: GEOLOGY AND VEGETATION**

| Route | Route Option | Length (miles) | Geologic, Water and Marine Resources | Drainage Basins and Watersheds | Vegetation and Aquatic Resources | |
|---|---|---|---|---|---|---|
| | | | | | Wetland Vegetation | Upland Vegetation |
| **Pt. Possession to Pt. Woronzof via Fire Island (Tesoro Route)** | **Route Option B**<br>Links T10, T11, T12, T13, T14 | 19.1 | **Inventory, Impacts, and Mitigation**<br>Terrestrial resources and hazards<br>▪ 0.1 mile prone to slope instability (southwest end of Fire Island) – mitigated: see Route Option A<br>▪ **No significant impacts**<br>Near-coast resources<br>▪ Erosion from trenching of tidal mudflats and saltmarsh with selective material backfill (Fire Island and Pt. Woronzof) – could be mitigated by horizontal directional drilling<br>▪ **No significant impacts**<br>Marine hazards<br>▪ 3.8 miles boulder/cobble areas – submarine cable embedment not feasible<br>▪ 7.1 miles subject to ice scour or impact from ice floes and pressure ridges – 1.0 mile mitigated by submarine cable embedment<br>▪ 0.5 mile prone to slope instability – submarine cable embedment not feasible<br>**Least Preferred Route Option**<br>▪ Slope instability at Fire Island<br>**Preference: 2** | No stream crossings anticipated on Fire Island | **Inventory**<br>▪ 2.8 acres saltmarsh potentially affected<br>**Impacts and Mitigation**<br>▪ Directional boring could mitigate impacts on saltmarsh<br>▪ **No significant impacts**<br>**Preference: 2** | **Inventory**<br>▪ 22.8 acres of closed mixed forest potentially affected<br>**Impacts and Mitigation**<br>▪ Spruce bark beetle mitigation<br>▪ **No significant impacts**<br>**Preference: 2** |
| **Pt. Possession to Pt. Woronzof (Tesoro Route)** | **Route Option C****<br>Link T15 | 17.2 | **Inventory, Impacts, and Mitigation**<br>Near-coast resources<br>▪ Erosion from trenching of tidal mudflats and saltmarsh with selective material backfill (Pt. Woronzof) – could be mitigated by horizontal directional drilling<br>▪ **No significant impacts**<br>Marine hazards<br>▪ 1.5 miles boulder/cobble areas – submarine cable embedment not feasible<br>▪ 9.8 miles of submarine areas subject to ice scour or impact from ice floes and pressure ridges – 8.5 miles mitigated by submarine cable embedment<br>**Preference: 1** | Submarine Route | **Inventory**<br>▪ No wetland vegetation<br>**Preferred Route Option**<br>▪ No wetland vegetation<br>**Preference: 1** | **Inventory**<br>▪ 0.5 acre of closed mixed forest potentially affected<br>**Impacts and Mitigation**<br>▪ Selective clearing and avoidance by cable location<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Small amount of vegetation with impacts possibly avoided<br>**Preference: 1** |
| **Pt. Possession to Pt. Campbell (Tesoro Route)** | **Route Option D**<br>Links T16, T17 | 13.9 | **Inventory, Impacts, and Mitigation**<br>Terrestrial resources and hazards<br>▪ 1.0 mile of roadless area would be crossed – mitigated by restricting construction to winter months or use of low ground pressure vehicles<br>▪ **No significant impacts**<br>Near-coast resources<br>▪ Erosion from trenching of tidal mudflats and saltmarsh with selective material backfill (Pt. Campbell) – could be mitigated by horizontal directional drilling<br>▪ **No significant impacts**<br>Marine hazards<br>▪ 1.5 miles boulder/cobble areas – submarine cable embedment not feasible<br>▪ 7.1 miles subject to ice scour or impact from ice floes and pressure ridges – 5.8 miles mitigated by submarine cable embedment<br>▪ 0.1 mile prone to slope instability – submarine cable embedment not feasible<br>**Preference: 1** | Submarine Route | **Inventory**<br>▪ No wetland vegetation<br>**Preferred Route Option**<br>▪ No wetland vegetation<br>**Preference: 1** | **Inventory**<br>▪ No upland vegetation<br>**Preferred Route Option**<br>▪ No upland vegetation<br>**Preference : 1** |

****Environmentally Preferred Route**

**TABLE 2-11B**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**TURNAGAIN ARM: GEOLOGY AND VEGETATION**

| Route | Route Option | Length (miles) | Geologic, Water and Marine Resources | Drainage Basins and Watersheds | Vegetation and Aquatic Resources | |
|---|---|---|---|---|---|---|
| | | | | | **Wetland Vegetation** | **Upland Vegetation** |
| **Chickaloon Bay to Klatt Road (Enstar Route)** | **Route Option G** Link E11 | 11.2 | **Inventory, Impacts, and Mitigation**<br>Near-coast resources<br>▪ Erosion from trenching of tidal mudflats and saltmarsh with selective material backfill (Chickaloon tidal mudflats) – could be mitigated by horizontal directional drilling<br>▪ **No significant impacts**<br>Marine hazards<br>▪ 8.4 miles of submarine areas subject to ice scour or impact from ice floes and pressure ridges – mitigated by submarine cable embedment<br>**Preference: 1** | Submarine Route | **Inventory**<br>▪ 2.3 acres saltmarsh potentially affected<br>**Impacts and Mitigation**<br>▪ Directional boring would avoid impacts on saltmarsh<br>▪ **No significant impacts**<br>**Preference: 1** | **Inventory**<br>▪ No upland vegetation<br>**Preferred Route Option**<br>▪ No upland vegetation<br>**Preference: 1** |
| **Chickaloon Bay to Oceanview (Enstar Route)** | **Route Option H*** Link E12 | 10.5 | **Inventory, Impacts, and Mitigation**<br>Near-coast resources<br>▪ Erosion from trenching of tidal mudflats and saltmarsh with selective material backfill (Chickaloon tidal mudflats) - could be mitigated by horizontal directional drilling<br>▪ **No significant impacts**<br>Marine hazards<br>▪ 10.5 miles subject to ice scour or impact from ice floes and pressure ridges – mitigated by submarine cable embedment<br>▪ 0.3 mile prone to slope instability - submarine cable embedment not feasible<br>**Preference: 1** | Submarine Route | **Inventory**<br>▪ 9.7 acres saltmarsh potentially affected<br>**Impacts and Mitigation**<br>▪ Directional boring would avoid impacts on saltmarsh<br>▪ **No significant impacts**<br>**Least Preferred Route Option**<br>▪ Greatest amount of saltmarsh potentially affected<br>**Preference: 2** | **Inventory**<br>▪ 1.0 acre of closed mixed forest affected<br>**Impacts and Mitigation**<br>▪ Selective clearing<br>▪ **No significant impacts**<br>**Preference: 1** |
| **Chickaloon Bay to Rabbit Creek (Enstar Route)** | **Route Option I** Link E13 | 9.0 | **Inventory, Impacts, and Mitigation**<br>Near-coast resources<br>▪ Erosion from trenching of tidal mudflats and saltmarsh with selective material backfill (Chickaloon tidal mudflats) - could be mitigated by horizontal directional drilling<br>▪ **No significant impacts**<br>Marine hazards<br>▪ 10.1 miles of submarine areas subject to ice scour or impact from ice floes and pressure ridges - mitigated by submarine cable embedment<br>▪ 0.3 mile of submarine and coastal areas prone to slope instability – submarine cable embedment not feasible<br>**Preference: 1** | Submarine Route | **Inventory**<br>▪ 1.2 acres saltmarsh potentially affected<br>**Impacts and Mitigation**<br>▪ Directional boring would avoid impacts on saltmarsh<br>▪ **No significant impacts**<br>**Preference: 1** | **Inventory**<br>▪ No upland vegetation<br>**Preferred Route Option**<br>▪ No upland vegetation<br>**Preference : 1** |

***Applicant's Proposed Route**

**TABLE 2-11B**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**TURNAGAIN ARM: WILDLIFE RESOURES**

| Route | Route Option | Length (miles) | Wildlife Selected Resources[1] | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Anadromous Fish** | **Birds** | **Large Mammals** | **Predators** | **Marine Mammals** | **Threatened and Endangered Species** |
| **Pt. Possession to Pt. Woronzof via Fire Island (Tesoro Route)** | **Route Option B**<br>Links T10, T11, T12, T13, T14 | 19.1 | **Impacts and Mitigation**<br>▪ No anadromous fish streams<br>▪ Not a factor in route comparison | **Impacts and Mitigation**<br>▪ Disturbance to nesting waterfowl (Fire Island) - **locally significant impacts during construction**<br>▪ Collision hazard (Fire Island - wire marking near lakes) - **locally significant impacts**<br>▪ No loss of habitat<br>**Preference: 3** | **Impacts and Mitigation**<br>▪ Temporary displacement of black bears and brown bears at Pt. Possession - **no significant impacts**<br>▪ Clearing in moose winter range/creation of new winter range on Fire Island - **no significant impacts**<br>**Preference: 2** | **Impacts and Mitigation**<br>▪ Wolf and lynx not present<br>▪ Not a factor in route comparison | **Impacts and Mitigation**<br>▪ Limited noise disturbance<br>▪ No calving areas – **no significant impacts** | **Impacts and Mitigation**<br>▪ Stellar sea lion present only on very rare occasion<br>▪ Not a factor in route comparison |
| **Pt. Possession to Pt. Woronzof (Tesoro Route)** | **Route Option C****<br>Link T15 | 17.2 | **Same as Route Option B** | **Impacts and Mitigation**<br>▪ No disturbance to nesting waterfowl<br>▪ No loss of habitat<br>**Preferred Route Option**<br>▪ No disturbance to nesting waterfowl<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ Temporary displacement of black bears and brown bears at Pt. Possession – **no significant impacts**<br>**Preferred Route Option**<br>▪ No clearing of moose winter range<br>**Preference: 1** | **Same as Route Option B** | **Same as Route Option B** | **Same as Route Option B** |
| **Pt. Possession to Pt. Campbell (Tesoro Route)** | **Route Option D**<br>Links T16, T17 | 13.9 | **Same as Route Option B** | **Impacts and Mitigation**<br>▪ Disturbance to nesting waterfowl at edge of habitat (Pt. Campbell) – **locally significant impacts during construction**<br>▪ No loss of habitat<br>**Preference: 2** | **Same as Route Option C** | **Same as Route Option B** | **Same as Route Option B** | **Same as Route Option B** |

****Environmentally Preferred Route**

Route options D through H are preferred to route options I through L for wildlife in the Turnagain Arm area.

**TABLE 2-11B**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**TURNAGAIN ARM: WILDLIFE RESOURES**

| Route | Route Option | Length (miles) | Wildlife Selected Resources | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Anadromous Fish** | **Birds** | **Large Mammals** | **Predators** | **Marine Mammals** | **Threatened and Endangered Species** |
| **Chickaloon Bay to Klatt Road (Enstar Route)** | **Route Option G** Link E11 | 11.2 | **Impacts and Mitigation**<br>▪ No anadromous fish streams<br>▪ Not a factor in route comparison | **Impacts and Mitigation**<br>▪ Disturbance to nesting waterfowl within concentration areas at Chickaloon Bay (KNWR) and ACWR, especially high quality habitat at Chickaloon Bay – **locally significant impacts at ACWR, nationally significant impacts on KNWR during construction**<br>▪ No loss of habitat<br>**Preference: 1** | **Impacts and Mitigation**<br>▪ Disturbance to black bear spring feeding at Chickaloon Bay (KNWR) – **nationally significant impacts**<br>▪ Temporary displacement of brown bears at Chickaloon Bay (KNWR) – **nationally significant impacts** | **Impacts and Mitigation**<br>▪ Wolf and lynx not present<br>▪ Not a factor in route comparison | **Impacts and Mitigation**<br>▪ Limited noise disturbance<br>▪ Calving areas<br>▪ Calving season should be avoided - **no significant impacts** | **Impacts and Mitigation**<br>▪ Stellar sea lion present only on very rare occasions<br>▪ Not a factor in route comparison |
| **Chickaloon Bay to Oceanview (Enstar Route)** | **Route Option H*** Link E12 | 10.5 | **Same as Route Option G** | **Same as Route Option G** | **Same as Route Option G** | **Same as Route Option G** | **Same as Route Option G** | **Same as Route Option G** |
| **Chickaloon Bay to Rabbit Creek (Enstar Route)** | **Route Option I** Link E13 | 9.0 | **Same as Route Option G** | **Impacts and Mitigation**<br>▪ Disturbance to nesting waterfowl within concentration areas at Chickaloon Bay (KNWR) and ACWR and known bald eagle nesting area at ACWR, Potter Marsh higher quality than rest of ACWR<br>▪ No loss of habitat<br>**Least Preferred Route Option**<br>▪ Potential disturbance to waterfowl in the vicinity of Potter Marsh area during construction<br>**Preference: 2** | **Same as Route Option G** | **Same as Route Option G** | **Same as Route Option G** | **Same as Route Option G** |

***Applicant's Proposed Route**

**TABLE 2-11C**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**ANCHORAGE BOWL: LAND USE**

| Route | Route Option | Length (miles) | Linear Features (miles) | | | | Jurisdiction (miles) | | | | | | | | | Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pipeline Parallel | Transmission line parallel/ rebuild | Railroad parallel | Paved/gravel road parallel | Private | Kenai Peninsula Borough | Municipality of Anchorage (includes private) | State | U.S. Fish and Wildlife Service | Cook Inlet Region Inc. (CIRI) | Salamatof Native Association | Pt. Possession Group | Kenai Native Association | Existing and Future Land Use | Recreation | Summary of Community Working Group Issues | Agency Comments |
| **Pt. Campbell to Pt. Woronzof (Tesoro Route)** | **Route Option N** Link T18 | 4.0 | 2.8 | -- | -- | -- | -- | -- | 3.8 | 0.2 | -- | -- | -- | -- | -- | **Inventory**<br>■ Pt. Campbell to Pt. Woronzof<br>■ Parallels Tesoro Pipeline and future road edge<br>■ Anchorage International Airport<br>**Impacts and Mitigation**<br>■ Line would be undergrounded through park to mitigate airspace interference with airport; parallel to pipeline and road | **Inventory**<br>■ Crosses Kincaid Park<br>■ Crosses ACWR<br>■ Crosses Tony Knowles Coastal Trail<br>**Impacts and Mitigation**<br>■ Short-term construction impacts | ■ Concerns over the loss of vegetation and disruption to the Tony Knowles Coastal Trail and Kincaid Park<br>**Preference: 2** | ■ Compatibility with Kincaid Park<br>■ Impacts to ACWR |
| **Klatt to International (Enstar Route)** | **Route Option J** Links A1, A2, A3, A4, A5 | 5.1 | -- | 0.3 | -- | 4.4 | -- | -- | 5.1 | -- | -- | -- | -- | -- | -- | **Inventory**<br>■ Planned residential development adjacent to route<br>■ Parallels road right-of-way<br>**Impacts and Mitigation**<br>■ Line would be relocated within right-of-way; underground and overhead line<br>**Preference: 1** | **Inventory**<br>■ Crosses Campbell Creek Greenbelt<br>■ Open space adjacent to Minnesota Drive<br>**Impacts and Mitigation**<br>■ **No recreation impacts**<br>**Preference: 3** | ■ Impacts to residential areas adjacent to route<br>■ Visual impacts to Minnesota Drive Corridor<br>**Preference: 2** | ■ Conflicts with ADOT plans for improvement along Minnesota Drive<br>■ Limited access along Minnesota Drive<br>■ Visual impacts to travel corridor |
| **Alaska Railroad/Oceanview to International (Enstar Route)** | **Route Option K*** Links A6, A7, A8, A9, A 10 | 5.4 | -- | -- | 0.3 | -- | -- | -- | 5.4 | -- | -- | -- | -- | -- | -- | **Inventory**<br>■ Submarine landing at Oceanview Bluff Park<br>■ Parallels railroad right-of-way to substation<br>■ Flying Crown Airport adjacent to tracks<br>**Impacts and Mitigation**<br>■ Underground line past airport within railroad right-of-way; no impacts to aviation<br>**Preference: 1** | **Inventory**<br>■ Oceanview Bluff Park<br>■ Crosses Campbell Creek Greenbelt<br>**Impacts and Mitigation**<br>■ Short-term construction impacts; mitigation would include replacement of picnic facilities and revegetation of disturbed areas<br>**Preference: 1** | ■ Impacts to residential neighborhoods<br>■ Visual impacts along railroad corridor<br>■ Conflict with expansion of Oceanview Bluff Park<br>**Preference: 1** | ■ Oceanview Bluff Park - MOA |

***Applicant's Proposed Route**

**TABLE 2-11C**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**ANCHORAGE BOWL: LAND USE**

| Route | Route Option | Length (miles) | Linear Features (miles) | | | | Jurisdiction (miles) | | | | | | | | Land Use | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pipeline Parallel | Transmission line parallel/ rebuild | Railroad parallel | Paved/gravel road parallel | Private | Kenai Peninsula Borough | Municipality of Anchorage (includes private) | State | U.S. Fish and Wildlife Service | Cook Inlet Region Inc. (CIRI) | Salamatof Native Association | Pt. Possession Group | Kenai Native Association | Existing and Future Land Use | Recreation | Summary of Community Working Group Issues | Agency Comments |
| **Rabbit Creek to International via Old Seward Highway (Enstar Route)** | **Route Option M**<br>Links A11, A13, A14, A15, A16 | 8.9 | -- | 6.6 | 7.9 | -- | -- | -- | 8.9 | -- | -- | -- | -- | -- | -- | **Inventory**<br>■ Residential and commercial parcels crossed<br>■ Parallel to Old Seward Highway and International Road<br>■ Submarine landing at Alaska Railroad/Rabbit Creek<br>**Impacts and Mitigation**<br>■ Mitigation would be to rebuild existing distribution line within the road right-of-way<br>**Preference: 2** | **Inventory**<br>■ Rabbit Creek Rifle Range<br>■ Crosses Campbell Creek Greenbelt<br>**Impacts and Mitigation**<br>■ No recreation impacts<br>**Preference: 1** | ■ Impacts to residential neighborhoods through Oceanview<br>■ Visual impacts along Old Seward Highway<br>■ Impacts to residential areas adjacent to route<br>**Preference: 4** | ■ Conflicts with ADOT plans for improvements along Old Seward Highway and International Airport Road/Old Seward Interchange<br>■ Visual impacts to travel corridor |

**TABLE 2-11C**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**ANCHORAGE BOWL: SOCIEOCONOMIC, SUBSISTENCE, CULTURAL, AND VISUAL**

| Route | Route Option | Length (miles) | Socioeconomic | Subsistence | Cultural Resources | Visual Resources | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Landscape Scenery | Residential and Recreation Views | Travel Way Views | Summary of Visual Impacts and Mitigation (miles) |
| **Pt. Campbell to Pt. Woronzof (Tesoro Route)** | **Route Option N**<br>Link T18 | 4.0 | **Impacts and Mitigation**<br>■ Mostly local construction workers<br>■ 10 to 15 non-local workers to be hired<br>■ Influx of workers for submerged segments not significant to economy<br>■ **No significant impacts** | N/A | **Impacts**<br>■ Low potential impact area | **Local Context**<br>■ Primarily park-like image type, as well as some industrial areas<br>**Regional Context**<br>■ Cook Inlet, Turnagain Arm, Knik Arm with distant view to Mt. Susitna, Mt. McKinley | **Views**<br>■ Immediate foreground and foreground views from recreation area (Tony Knowles Coastal Trail) | ■ Parallels portions of the Tony Knowles Coastal Trail | **Impacts**<br>■ **No significant visual impacts to views within Kincaid Park**<br>**Mitigation**<br>■ To minimize ground disturbance new access roads will follow the landform contour<br>■ Clearing of right-of-way will be minimized<br>■ Trees will be removed selectively to blend the edge of the right-of-way into adjacent vegetation patterns<br>■ This route option will be underground due to location within a park and requirements within the flight path of the Anchorage Airport |
| **Klatt to International (Enstar Route)** | **Route Option J**<br>Links A1, A2, A3, A4, A5 | 5.1 | **Same as Route Option N** | N/A | **Impacts**<br>■ Low potential impact area<br><br>**Preference: 1** | **Local Context**<br>■ Primarily residential interspersed with undeveloped natural areas<br>**Regional Context**<br>■ Turnagain Arm, Anchorage Development | **Views**<br>■ Immediate foreground and foreground views from residential areas<br>■ Immediate foreground and foreground views from recreation areas (Pioneer Park, Heritage Land Trust/future park, Campbell Creek Greenbelt, and Javier De La Vega Park | ■ Parallels portions of Klatt Road, O'Malley Road, and Minnesota Drive | **Impacts**<br>■ 1.0 mile of significant visual impacts<br>**Mitigation**<br>■ To minimize ground disturbance new access roads will follow the landform contour<br>■ To reduce visual impacts on recreation areas and safety at highway and trail crossings towers will be placed at the maximum feasible distance from the crossing within limits of standard tower design<br>■ "Dulled" metal or corten finish on towers will be used to reduce visual impacts<br>■ Clearing of right-of-way will be minimized<br>■ Trees will be removed selectively to blend the edge of the right-of-way into adjacent vegetation patterns<br>**Preference: 2** |

**TABLE 2-11C**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**ANCHORAGE BOWL: SOCIEOCONOMIC, SUBSISTENCE, CULTURAL, AND VISUAL**

| Route | Route Option | Length (miles) | Socioeconomic | Subsistence | Cultural Resources | Visual Resources | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Landscape Scenery | Residential and Recreation Views | Travel Way Views | Summary of Visual Impacts and Mitigation (miles) |
| **Alaska Railroad/Oceanview to International (Enstar Route)** | **Route Option K*** Links A6, A7, A8, A9, A10 | 5.4 | **Same as Route Option N** | N/A | **Impacts**<br>■ Low potential impact area<br>**Preference: 1** | **Local Context**<br>■ Primarily an industrial image type interspersed with residential, commercial, and park-like areas<br>**Regional Context**<br>■ Anchorage Development | **Views**<br>■ Immediate foreground and foreground views from residential areas<br>■ Immediate foreground and foreground views from recreation areas (Campbell Creek Greenbelt and Javier De La Vega Park) | ■ Parallels portions of the Alaska Railroad | **Impacts**<br>■ 1.0 mile of significant visual impacts<br>**Mitigation**<br>■ Single-shaft steel poles will be used in place of larger, more visually dominant structures in order to reduce structural contrast<br>■ To reduce visual impacts on recreation areas and safety at highway and trail crossings towers will be placed at the maximum feasible distance from the crossing within limits of standard tower design<br>■ "Dulled" metal or corten finish on towers will be used to reduce visual impacts<br>■ Clearing of right-of-way will be minimized<br>■ Trees will be removed selectively to blend the edge of the right-of-way into adjacent vegetation patterns<br>■ To minimize visual impacts transition facilities will be placed within a small enclosed building in context with the surrounding architecture<br>**Preference: 1** |
| **Rabbit Creek to International via Old Seward Highway (Enstar Route)** | **Route Option M** Links A11, A13, A14, A15, A16 | 8.9 | **Same as Route Option N** | N/A | **Impacts**<br>■ Low potential impact area<br>**Preference: 1** | **Local Context**<br>■ Primarily commercial and residential image types interspersed with industrial and park-like areas<br>**Regional Context**<br>■ Anchorage Development | **Views**<br>■ Immediate foreground and foreground views from residential areas<br>■ Immediate foreground and foreground views from recreation areas (Rabbit Creek Rifle Range, Community Ball Fields on Old Seward Highway, Campbell Creek Greenbelt, and Javier De La Vega Park) | ■ Parallels portions of the Old Seward Highway and International Airport Road | **Impacts**<br>■ 2.6 miles of significant visual impacts<br>**Mitigation**<br>■ Single-shaft steel poles will be used in place of larger, more visually dominant structures in order to reduce structural contrast<br>■ Standard tower design will be modified to correspond with spacing of existing transmission line structures<br>■ To reduce visual impacts on recreation areas and safety at highway and trail crossings towers will be placed at the maximum feasible distance from the crossing within limits of standard tower design<br>■ "Dulled" metal or corten finish on towers will be used to reduce visual impacts<br>■ Trees will be removed selectively to blend the edge of the right-of-way into adjacent vegetation patterns<br>**Preference: 2** |

***Applicant's Proposed Route**

**TABLE 2-11C**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**ANCHORAGE BOWL: GEOLOGY AND VEGETATION**

| Route | Route Option | Length (miles) | Geologic, Water and Marine Resources | Drainage Basins and Watersheds | Vegetation and Aquatic Resources | |
|---|---|---|---|---|---|---|
| | | | | | Wetland Vegetation | Upland Vegetation |
| **Pt. Campbell to Pt. Woronzof (Tesoro Routes)** | **Route Option N**<br>Link T18 | 4.0 | **Inventory, Impacts, and Mitigation**<br>▪ Cable underground over entire route option<br>▪ 1.2 mile prone to slope instability - mitigated: see Route A<br>▪ 1.0 mile of roadless area - mitigated by routing new access to reduce scarring of landscape<br>▪ **No significant impacts** | **Inventory, Impacts, and Mitigation**<br>▪ Cable underground over entire route option<br>▪ **No significant impacts** | **Inventory**<br>▪ 0.5 acre saltmarsh potentially affected<br>**Impacts and Mitigation**<br>▪ Directional boring below saltmarsh<br>▪ **No significant impacts** | **Inventory and Impacts**<br>▪ 10.2 acres closed mixed forest potentially affected<br>**Mitigation**<br>▪ Selective clearing<br>▪ **No significant impacts** |
| **Klatt Road to International via Minnesota Drive (Enstar Routes)** | **Route Option J**<br>Links A1, A2, A3, A4, A5 | 5.1 | **Inventory, Impacts, and Mitigation**<br>▪ 1.8 miles compressible materials - mitigated: see Route Option A<br>▪ Access road construction over 0.04 mile of Link A1<br>▪ **No significant impacts**<br>**Preference: 1** | **Inventory, Impacts, and Mitigation**<br>▪ Streams and Associated Floodplains Crossed<br>- Campbell Creek<br>▪ One stream crossing – mitigated: see Route Option A<br>▪ 0.1 mile 100-year floodplain – mitigated: see Route Option A<br>▪ **No significant impacts** | **Inventory and Impacts**<br>▪ 0.2 acre black spruce bogs potentially affected<br>**Mitigation**<br>▪ Spanning low-growing vegetation<br>▪ Not improving existing roads<br>▪ Selective clearing<br>▪ **No significant impacts**<br>**Preference: 1** | **Inventory and Impacts**<br>▪ 0.4 acre closed mixed spruce forest potentially affected<br>**Mitigation**<br>▪ Selective clearing<br>▪ Spanning low-growing vegetation<br>▪ **No significant impacts**<br>**Preference: 1** |
| **Oceanview to International via Alaska Railroad (Enstar Routes)** | **Route Option K***<br>Links A6, A7, A8, A9, A10 | 5.4 | **Inventory, Impacts, and Mitigation**<br>▪ **No significant impacts**<br>**Preference: 1** | **Inventory, Impacts, and Mitigation**<br>▪ Streams and Associated Floodplains Crossed<br>- Campbell Creek (twice)<br>▪ Two stream crossings – mitigated: see Route Option A<br>▪ Flood zones generally 400 to 1,000 feet wide<br>▪ Mitigation measures include utilizing railroad right-of-way to eliminate need for new crossing at Campbell Creek<br>▪ **No significant impacts** | **Inventory and Impacts**<br>▪ 0.1 acre black spruce bogs potentially affected<br>**Mitigation**<br>▪ Spanning low-growing vegetation<br>▪ Not improving existing roads<br>▪ Selective clearing<br>▪ Limited clearing of right-of-way<br>▪ **No significant impacts**<br>**Preference: 1** | **Inventory and Impacts**<br>▪ 0.5 acre closed mixed spruce forest potentially affected<br>**Mitigation**<br>▪ Selective clearing<br>▪ **No significant impacts**<br>**Preference: 1** |
| **Rabbit Creek to International Substation via Old Seward Highway (Enstar Routes)** | **Route Option M**<br>Links A11, A13, A14, A15, A16 | 8.9 | **Inventory, Impacts, and Mitigation**<br>▪ **No significant impacts**<br>**Preference: 1** | **Inventory, Impacts, and Mitigation**<br>▪ Streams and Associated Floodplains Crossed<br>- Campbell Creek<br>- Furrow Creek<br>- Rabbit Creek<br>▪ Five stream crossings – mitigated: see Route Option A<br>▪ 0.6 mile 100-year floodplain – mitigated: see Route Option A<br>▪ Campbell Creek flood zone is approximately 500 to 1,000 feet wide<br>▪ **No significant impacts** | **Inventory and Impacts**<br>▪ 0.9 acre saltmarsh potentially affected<br>**Mitigation**<br>▪ Directional boring below saltmarsh<br>▪ Spanning low-growing vegetation<br>▪ Not improving existing roads<br>▪ Selective clearing<br>▪ **No significant impacts**<br>**Preference: 1** | **Inventory and Impacts**<br>▪ 0.6 acre closed mixed spruce forest potentially affected<br>**Mitigation**<br>▪ Selective clearing<br>▪ **No significant impacts**<br>**Preferred Route Option**<br>▪ Old Seward Highway and Railroad right-of-ways<br>**Preference: 1** |

***Applicant's Proposed Route**

**TABLE 2-11C**
**ALTERNATIVE ROUTE OPTION COMPARISON**
**ANCHORAGE BOWL: WILDLIFE RESOURES**

| Route | Route Option | Length (miles) | Wildlife Selected Resources | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | **Anadromous Fish** | **Birds** | **Large Mammals** | **Predators** | **Marine Mammals** | **Threatened and Endangered Species** |
| **Pt. Campbell to Pt. Woronzof (Tesoro and Enstar Routes)** | **Route Option N** Link T18 | 4.0 | **Impacts and Mitigation**<br>▪ No anadromous fish streams<br>▪ Not a factor in route comparison | **Impacts and Mitigation**<br>▪ Waterfowl habitat very limited – **no significant impacts**<br>▪ Clearing within 0.25 mile of known bald eagle nest - selective tree removal - **locally significant impacts**<br><br>**Preference:** | **Impacts and Mitigation**<br>▪ Clearing within moose winter range/creation of new winter range in Kincaid Park - **no significant impacts** | **Impacts and Mitigation**<br>▪ Limited habitat for wolf and lynx in Kincaid Park area - **no significant impacts** | **Impacts and Mitigation**<br>▪ No habitat for marine mammals<br>▪ Not a factor in route comparison | **Impacts and Mitigation**<br>▪ No habitat for threatened or endangered species<br>▪ Not a factor in route comparison |
| **Klatt to International Substation (Enstar Routes)** | **Route Option J** Links A1, A2, A3, A4, A5 | 5.1 | **Inventory**<br>▪ One anadromous fish stream crossing<br>**Impacts and Mitigation**<br>▪ Anadromous fish stream would be spanned – **no significant impacts** | **Inventory and Impacts**<br>▪ Waterfowl habitat limited – **no significant impacts**<br>▪ No known bald eagle nesting areas - **no significant impacts**<br><br>**Preference: 1** | **Impacts and Mitigation**<br>▪ Clearing within moose winter range/creation of new winter range in urban setting - **no significant impacts** | **Impacts and Mitigation**<br>▪ No wolf or lynx habitat - **no impacts** | **Same as Route Option N** | **Same as Route Option N** |
| **Oceanview to International Substation via Alaska Railroad (Enstar Route)** | **Route Option K*** Links A6, A7, A8, A9, A10 | 5.4 | **Same as Route Option J** | **Same as Route Option J** | **Same as Route Option J** | **Same as Route Option J** | **Same as Route Option N** | **Same as Route Option N** |
| **Rabbit Creek to International Substation via Seward Highway (Enstar Route)** | **Route Option M** Links A11, A13, A14, A15, A16 | 8.9 | **Inventory**<br>▪ Four anadromous fish stream crossings<br>**Impacts and Mitigation**<br>▪ Anadromous fish streams spanned<br>▪ Submarine cable would be bored under Rabbit Creek – **no significant impacts** | **Impacts and Mitigation**<br>▪ Disturbance to staging waterfowl at Potter Marsh and known bald eagle nesting area – **locally significant impacts** | **Same as Route Option N** | **Same as Route Option N** | **Same as Route Option N** | **Same as Route Option N** |

***Applicant's Proposed Route**